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THESIS

THE USE OF FILMS IN TEACHING THE UNIT WEATHER FOR GRADE NINE

Submitted by

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Submitted in Partial Fulfillment of the Requirements
for the Degree of Master of Education

1938

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TABLE OF CONTENTS

CHAPTER		Pages
I.	History of General Science	1-11
II.	Motion Pictures in Education	12-20
III.	Teaching With Films	21-26
IV.	Aims of General Science	27-30
V.	Methods of General Science Teaching	31-38
VI.	The Experiment	39-98
	1. Purpose of the Experiment	39-42
	2. Description of the Experiment	42-49
	a. Technique Employed	46-47
	b. Teaching Procedure for the Control Group	48
	c. Teaching Procedure for the Experimental Group	48-49
	3. Selection of Subject Matter	49-62
	a. Reference List No. 1	55-56
	b. Digest of Subject Matter and Films to Match	56-59
	c. Generalizations	60-62
	4. Selection of Films	62-67
	5. The Physical Properties Concerning the Experiment	67-69
	6. Tests	69-79
	a. Test 1. Atmospheric Pressure	72-74
	b. Test 2. The Water Cycle	74-75

Table of Contents (Concluded)

	Pages
c. Test 3. Weather Forecasting	75-77
d. Test 4. Climate	77-79
7. Results of the Experiment	79-93
a. Significance of the Percentage Differences	82-89
b. Significance of the Final Percentage Differences	85
8. Summary	94-98
a. Brief Description	94-96
b. General Results	96
c. Further Problems	96-98
d. Limitations of the Study	98
VII. Appendix	
1. Form Letter Used	99
2. List of Producers and Distributors	100-106
3. 16 m m Films Not Used	106-107
4. Directing Questions Used in Teaching	107-110
5. General Plan of Subject Matter	110-115
VIII. Bibliography	116-121

LIST OF TABLES

TABLE		PAGES
I.	Equation of Class Groups	44-45
II. A.	Showing the scores made by pupils in five different classes who saw the film after the pre-test and before the test. In other words, the scores for the film group.	86
II. B.	Showing the scores made by pupils in five different classes who used the textbook after pre-test and before test. In other words, scores for the non-film group.	87
III. A.	Showing the scores made by pupils in five different classes who saw the film after the pre-test and before the test. In other words, the scores for the film group.	88
III. B.	Showing the scores made by pupils in five different classes who used the textbook after pre-test and before test. In other words, scores for the non-film group.	89
IV. A.	Showing the scores made by pupils in five different classes who saw the film after the pre-test and before the test. In other words, the scores for the film group.	90
IV. B.	Showing the scores made by pupils in five different classes who used the textbook after pre-test and before test. In other words, scores for the non-film group.	91
V. A.	Showing the scores made by pupils in five different classes who saw the film after the pre-test and before the test. In other words, the scores for the film group.	92
V. B.	Showing the scores made by pupils in five different classes who used the textbook after pre-test and before test. In other words, scores for the non-film group.	93

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LIST OF CHARTS

CHART		PAGES
I.	Showing the number of pages of subject matter found under each of the special sciences in the textbook by Hodgdon entitled Elementary General Science.	5-6
II.	Showing the number of pages of subject matter found under each of the special sciences in the textbook by Hessler entitled Junior Science.	8-9
III.		43
IV.	A list of all the topics on weather taken from 18 science books consulted and represented on the chart by letters. The letters correspond to the books listed under "Sources of Subject Matter". The frequency of the topics is shown by crosses.	50-54

CHAPTER I

HISTORY OF GENERAL SCIENCE

General Science as an independent subject is the latest addition to the science family--a family that came into being, or rather into its own, about the middle of the 19th century.[22:1/*] A rapid survey of the years intervening between the scientific awakening (in 1662)[22:1/] and the birth of this new member of the science group will serve not only to create a background but also to explain the reason for the late appearance of this comparatively young but increasingly popular subject. Previous to the scientific awakening the European universities were entirely of a classical nature.[22:2/] It took the work of Comenius (1592-1670), Locke (1632-1704), Rousseau (1712-1770), Salzman (1744-1811), Pestalozzi (1746-1827), and Froebel (1782-1852) to establish this new form of education based on a study of natural objects. In the United States the first secondary schools were the Latin Grammar Schools [27:1/] whose sole duty was to prepare the pupils for the universities. They were solely for boys, and during the years 1635-1750 prospered and increased in this country. Their curricula were of course entirely classical and stressed the Latin and Greek languages. These schools in the course of time failed to meet the needs of the times and declined,

* All numbers refer to the numbers in the Bibliography. Where two numbers occur (as in this instance) the first number refers to the references, the second number to the page.

CHAPTER I

Sources of Corpus Christi

Chapter I concerns an informational analysis of the textual variations in the Corpus Christi manuscripts. Part I, Part II, and Part III, or rather the Corpus Christi, where the plays of the Corpus Christi cycle.[1] A study showing the more interesting features of the method of transmitting the text, and the length of time the scribes of the Corpus Christi cycle will every use only to consult a dictionary, but I do be expecting the process for the time appearance of the subjectively, which is in preparation, medieval manuscript. Effective in the manuscript manuscript the Corpus Christi manuscripts were authority of a dictionary always.[2] It took the work of Cornelius (1924-1930), Cooper (1924-1927), Bateson (1925-1929), Salmon (1924-1931), Wood-Legh (1928-1929), and Jewell (1931-1932) a combination of the form of combination based on a study of manuscript objects. In the United States the first manuscript scholarship was the Malin (Hammer Series).[3] Where only one to deposit the public for the university. Then were only for days, and work of the years 1930-1932 manuscript and the manuscript in this country. Their contribution was to assess scribal characteristics and determine the dating and force of manuscript. Their manuscript in the course of time failed to work the work of the [illegible] and [illegible],

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[1] Number refer to the numbers in the Bibliography. Where the numbers occur (1) in 1932 (Jewell) the first number refers to the reference, the second number to the page.

giving way to the academies. In 1743 Benjamin Franklin prepared a plan for an academy in Philadelphia.[27:2] One of the main purposes of the academy was to offer practical courses to those who could not go to college, and thus prepare boys and girls "for the common walks of business, government, and everyday life."[27:3] The subjects taught in these early academies included astronomy, natural philosophy, geography, botany, chemistry, and geology.[22:3] The public high school supplanted the academy (in 1821)[27:5] for the purpose of "affording a very practical training to those who had not the means, the time, or the inclination to attend a classical school."[25:2] Natural philosophy and astronomy were offered to the pupils of the Boston High School, and botany, chemistry, and natural history to the girls in their high school. It will be noticed that more and more stress was being placed on the practical subjects. According to Brown "the common people of these towns and cities were becoming desirous of more extended education; and the commercial activity of these centers called for a different kind of training from that offered by the schools designed to prepare for college."[25:3]

The type of science offered in these early schools was practically book science [27:7] with occasional laboratory demonstrations by the teacher, and field trips for the botany classes. Botany was exceedingly popular with the young ladies of this period and was studied by them as "an accomplishment."[27:7] Natural history and natural philosophy formed the backbone of the high school sciences with the physical and botanical fields getting more attention. Chemistry increased in popularity and so did zoölogy in spite of the opposition of the Latin

group who still felt that chemistry smacked of the "black art", and looked with disfavor on zoölogy because it had to do with animals.

One of the most important figures in the popularization of the sciences for public schools was Louis Agassiz. His motto, hung conspicuously in the laboratory, "Study nature and books", was always a symbol of his great influence. A student of Agassiz, Henry Straight, developed courses of study in nature study and geography which were the forerunners of science in the elementary schools of today.[22:9] The exact year that General Science was ushered into the curricula of secondary schools is uncertain. Some time in the late nineties of the 19th century there were at least three schools in the country in which General Science was on trial.[25:10] Frank in his book cites the year 1912 as the time when General Science became firmly established as a high school subject.[25:18] A study in 1901 of high school attendance showed that altogether too many people left high school during the first and second years. Pupils were dropping out of school evidently because the stereotyped program of Latin, algebra, Greek and Roman history, physical geography, English, and physiology had no appeal for them. They were both difficult and uninteresting, and the parents were in the main unable to offer help to the struggling pupil, with the result that thousands of pupils were forced through failure or dislike to drop out of high school. It is easy then to understand the great popularity of General Science when it was substituted for some of the other subjects. Both pupils and parents saw its value almost immediately. The pupils not only found the material fascinating but they also evinced a desire to learn more about the other sciences.

The rise and increase of General Science textbooks was commensurate with the subject. The early texts in science were written primarily by clergymen.[22:17] After its inception into the high school, texts on general science were written by college men especially during the period of college dominance over high school. Most of the books of this period were labelled Introductory Science [27:21] and contained material about the various sciences with the stress placed particularly upon the one science in which the professor-author was most interested. If the book were written by a physics professor, a preponderance of physics material would be certain to be included in the work,[37:30] or if the writer were a teacher of biology, the text would be copiously flavored with materials biological. It was therefore more of a gesture than a fact to call the early books in General Science as such; it would have been more to the point to call them texts on elementary physics, biology, chemistry or zoölogy each containing a smattering of information about the other sciences interwoven through the whole. An example of this type of text is Elementary General Science by Daniel R. Hodgdon. The qualifications of Dr. Hodgdon are listed in the book under the author's title as:[32]

> Daniel Russell Hodgdon, Sc. D., LL. D., formerly President of Hahnemann Medical College and Hospital of Chicago, Director Industrial Educational Bureau, President of College of Technology, and Director School of Technology of Newark, Lecturer, Newark Institute, Member of the Faculty of New York University and New Jersey State Normal School.

There can be no doubt that this particular science book was written by a college man and professor. The book includes a total of 619 pages covering the following lists of topics: Atmospheric Moisture and

Evaporation, Moisture Coming Out of the Atmosphere, The Atmosphere, Transmission of Heat, Expansion and Measure of Heat, Oxidation and Its Relation to Life, Foods, Water, Germs and Disease, Light and Its Relation to the World, Electricity, the Relation of Sound and Music to Us, the Universe, Machines and Work, Safety First. A chart will serve to bear out the fact that this is not General Science but a specific science with general topics added as fillers-in.

Page Numbers	Physics	Chemistry	Biology	Astronomy	Physiology	Geology	Meteor-ology
(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)
1-39	Moisture Evaporation						
40-61	Atmosphere						
62-86							Weather
87-134	Heat						
135-188		Oxidation					
189-200					Foods		
201-256		Food Content					
257-288		Water					
289-323					Germs Disease		
324-384	Light						
385-410	Electricity						
411-442	Sound						

Chart 1. Showing the number of pages of subject matter found under each of the special sciences in the textbook by Hodgdon entitled Elementary General Science.

Page Numbers	Physics	Chemistry	Biology	Astronomy	Physiology	Geology	Meteorology
(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)
443-490				Universe			
491-503	Machines Work						
Part II 1-88	Wireless						
Totals for each by Pages	Physics	Chemistry	Biology	Astronomy	Physiology	Geology	Meteorology
	323	139	0	47	45	0	24

Chart 1. (Concluded)

A study of the chart shows clearly the truth of the point made--that of the total number of pages in the textbook over 50 per cent of them was based on the single science "physics". It is extremely interesting to note the absence of material on biology and geology; evidently this particular author cared little for plants or animals. The combined pages of physics and chemistry total 462 which is 74 per cent of the total number of pages in the book. Does this not show a parallelism between the interests of the author and the list of titles that follow the author's name? Frank in his book expresses it clearly in his words, "Each book reflected the training of the author by the stress put upon the field with which he was best acquainted."[27:21/] However, in fairness to the above mentioned author and to the authors of other books published during this early period, the blame should not be placed on their shoulders, but rather upon the shoulders of the

education of the time. The interpretation of General Science for this period was entirely one of preparation for the various special sciences: biology, physics, or chemistry.

The next period, and the textbooks that accompanied it, had an entirely different aim. It was felt that the subject matter of General Science should in reality be what the name itself implied: both general and scientific. In other words, texts were prepared and written to include a certain amount of each of the special sciences. For example, anyone who was contemplating writing a textbook for General Science would first list the special sciences. With physics, chemistry, biology, and astronomy receiving a little more attention than geology, physiography, and physiology, the author would select a bit of subject matter for each science, and then incorporate this "hodge podge" between two covers and label the whole thing General Science. The result was accurate as far as terminology went, but was a failure educationally because in every instance the books failed to consider the interests, needs, and activities of the child. An illustration of this kind of textbook was John C. Hessler's Junior Science. Dr. Hessler was a professor of chemistry at Knox University. His book was written to enable the pupils of junior high schools "to begin a definite study of science" because, in the author's own words "few of the young people who go to school ever study the physical sciences at all and these few only at the end of their student careers." His book was a composite mixture of all the sciences and was an attempt to give to the pupils some of the fundamentals of each of the special sciences regardless of their intrinsic value to the pupils.

Part one was simply an introduction to science wherein the author endeavored to explain the meaning of science. Part two dealt with the atmosphere and its relation to man; part three, matter and energy in earth and sky; part four, science in the household; part five, how we use nature's forces; part six, living things and their relation to us; and part seven, our bodies and how to care for them. By tabulating the information and subject headings that appear under each of the seven parts or divisions of Hessler's book, a clearer understanding of the arrangement may be obtained, and it can be seen readily how each of the special sciences had space in the text devoted to it, and subject matter dealing with one or two specific phases of the sciences was presented regardless of the interests or needs of the child for whom the book was intended.

Page Numbers	Physics	Chemistry	Biology	Astronomy	Physiology	Geology	Meteorology
(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)
13-26	Air and Pressure						
27-42		Fire and Oxygen					
43-52		Carbon Carbon Dioxide					
53-61					Breathing Ventilation		
62-77	Heat						

Chart 2. Showing the number of pages of subject matter found under each of the special sciences in the text book by Hessler entitled Junior Science.

Page Numbers	Physics	Chemistry	Biology	Astronomy	Physiology	Geology	Meteor-ology
(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)
78-95							Weather
96-127				Heavenly Bodies			
128-163		Substan-ces Water					
164-191						Rocks Soil Miner-als	
192-206		Acids Alkalies					
207-233					Foods		
234-277	Magne-tism Elec-tricity						
278-313	Light						
314-325	Sound						
326-365	Simple Machines						
366-449			Plants Animals				
450-508					Our Bodies		
Totals for each by Pages	Physics	Chemistry	Biology	Astronomy	Physiology	Geology	Meteor-ology
	156	73	83	31	90	27	17

Chart 2. (Concluded)

A comparison of the chart made from information from Hodgdon's book and the previous chart made from Hessler's book reveals that Hessler's book has a wider, more complete distribution of information. A third chart made from a modern up-to-date General Science book would show a distribution somewhat similar to that of Hessler's, but instead of a "hodge podge" of unrelated units 27:21/ of the special sciences, the modern text is organized as a unified whole. This new step in organizing subject matter is based not on the subject matter itself, but on the needs, interests, and activities of the pupils in an endeavor to give the same pupils a broader understanding and a better appreciation of their environment. The authors of the newer textbooks are as a rule teachers in the General Science field, and many of them have actually tried out the subject matter and the methods in their own classes before embodying the ideas in text books. In this way the subject matter is treated by predetermined experiences in the classroom. A glance at the titles of some of the many modern textbooks will confirm this new organization of material. Some of the newer books have the following intriguing titles: Our Environment, Tours Through the World of Science, Science in Daily Life, Our Surroundings, Everyday Problems in Science, Exploring the World of Science, Science of Everyday Life, Science in Our World of Progress. All of the books bearing those titles are organized with the pupil as the center of activity and the material and subject matter are simply a means to an end.

Thus with its reorganization of materials, subject matter, and general content, due of course to the change in aims, method and general purpose, General Science today holds its place in the curricula

of most of the secondary schools in the country. Within the last few years there has been, also, a "definite trend in industrial nations toward the inclusion of liberal training in science in the program of studies for the elementary schools".[66:133]

General Science as the baby of the curriculum is in some respects most unique. Young indeed it is as a subject itself, but old it is in years since the subject matter upon which the course is founded deals with the earliest of the sciences. For example, the earliest books in Natural Philosophy "undertook to impart practical information regarding physical appliances in everyday use".[22:16] Because of its recent addition to the curriculum it has stimulated the whole program of studies. Aims and objectives of all subjects have never before received such consideration as at the present time, due in part to the impetus caused by the research and study which has been carried on as a prelude to the establishment of General Science as part of the curriculum of the modern school. Methods, techniques, skills and attitudes for all subjects have undergone a thorough overhauling due to this same impetus. It can be stated with authority and without prejudice that the addition of General Science to the curriculum has not only added to said curriculum its richness of aims and purposes, but it has also served as a great stimulant for the good of the other subjects within the secondary school curriculum, thus making a very important contribution to education in general.[59:233]

CHAPTER II

MOTION PICTURES IN EDUCATION

It is almost axiomatic that teaching may be enriched and learning facilitated through the application of practical methods of visual aids which bring concrete experiences into the classroom. Pupils need to be brought into direct contacts with objects and phenomena about which they desire to learn, and this can be done by creating situations in which they can see the things about which they are studying. It is a known fact that sensory experience is the foundation of intellectual activity.

Broadly speaking, Visual Instruction, the means of using the visual aids, is not a separate subject nor even a new procedure in teaching. It is merely a means to an end. Dorris in her book writes, "Visual instruction simply means the presentation of knowledge to be gained through the 'seeing experience.'. The 'seeing experience' has always been man's simplest and most natural means of gaining information."[21:6/] The advent of the motion picture simply added another link to the growing chain of visual aids. It is one of the greatest achievements of modern times, and is, perhaps, the most powerful influence on society today. Hoban in his book corroborates this with the following statement: "....most powerful of pictorial tools--undeveloped as yet. The motion picture is the most influential communicative medium in regard to human behavior. So influential in fact that

dictators regulate and control 'movies' in their countries."[31:239] Again, in the words of Rulon, "Possessing as it does the ability to portray objects in motion, the motion picture occupies a singular position among visual aids to instruction."[62:44]

Probably the first scientific application of the principle of "moving" pictures was made by Eadweard Muybridge in 1878. However, the real achievement did not follow until the combined efforts of George Eastman of Rochester and Thomas Edison made it possible to actually "take" motion pictures. To Eastman goes the credit of making the first celluloid film and to the immortal Edison a further triumph in making kinetograph, a device for taking "moving pictures". The kinetoscope, another of Edison's inventions, made possible the showing of these "moving pictures", and proved a great sensation at the Chicago World Fair in 1893. Although the kinetoscope showed "moving pictures" it used no curtain; it was left to C. Francis Jenkins and Thomas Armot to perfect and finally offer a picture machine which projected pictures on a screen. This occurred at the turn of the 19th century, and since that time the motion picture through its intrinsic power and world wide appeal has so captivated the public mind that today it is "universally utilized by the commercial and industrial world--it has invaded the church, the school and the home, and it has created an industry that ranks fifth in the world in wealth and output."[21:17] It is a far cry indeed from the first crude pictures shown without benefit of curtain to the modern "talkie" of today which has the power to reproduce not only those actions easily observed but is capable also of depicting those actions that are hardly discernible such as animation, slow

motion, time-lapse, microphotography and miniature photography. Hoban classifies the various films now available and being used in education into seven groups; they are:[31:250]

> (1) process films, a step by step illustration of a process, (2) skill films, showing how to master various skills such as typewriting, (3) dramatic films, such as the Yale Chronicles of American Photoplays, (4) industrial films, those which promulgate propaganda, (5) emotional films, (6) documentary films, and (7) background films.

In the motion picture there has been made available to education an instructional tool of tremendous power in its influence on the accumulation of knowledge and ideas, on the development of attitudes, and the directing of emotions, and on the shaping of other patterns of human conduct such as behavior, skills, and fashions. Educators have not been unmindful of its importance, but progress in the utilization of the motion picture in the classrooms of the schools has been slow and attended by many difficulties. A wealth of material is obtainable to show that there can be no question of the merits of the motion picture or its status in the educational systems in the country. Dale points out that "Experimental evidence shows that the motion picture develops learning in certain fields better than other tools of teaching."[17:3] This has been shown by the studies made by Wood and Freeman with General Science and Geography films,[79] Knowlton and Tilton in the field of History,[43] Rulon in General Science,[62] and Armspiger in Science.[2] Knowlton and Tilton say on this point, "The ten photoplays made a large contribution to the teaching of an enriched course of study, increasing the pupil's learning by about 19 per cent. This contribution was of such a magnitude that average children with the aid of the photoplays learned

as much as bright children did without them."[43:90] Helen C. Davis in her unpublished doctor's thesis writes:[18:110]

> The findings of this investigation indicate that the film has a distinct advantage over other forms of instruction in presenting one type of information. It should be used chiefly in presenting that information having to do with action. Its superior effectiveness cannot be claimed, however, for all types. It is no more valuable than other modes of presentation for some types and for information about objects it is less valuable than other methods unless those objects are clearly shown in motion or closely related to activity. If the film is to be most effective, it must present the specific items clearly and definitely.

This is indeed a clear warning to all teachers who erroneously feel that the mere showing of any picture is a guarantee of learning. The Thirty-First Year Book supports Miss Davis when it states:[66:84]

> Teachers should, however, be warned against one ever-present danger in the use of motion pictures, unless the lesson plan is made with unusual care to insure a focusing of the teacher's attention upon the specific aims to the end that desirable outcomes may be insured. This visual aid is likely to serve the pupils chiefly as effortless entertainment, an outcome likely to be obscured by the never-failing enthusiasm of the pupils and the apparent success of the device.

In those fields of instruction where motion pictures can be and are adapted, pupils learn more and remember longer what they have learned. Rulon in comparing a group which used films in a certain experiment with one which did not says on this point, "....these percentages indicate that not only did the film children learn more and remember more, but they remembered a larger percentage of the larger amount they had learned."[62:87-88]

The motion picture is especially valuable in attitude building. Thurstone and Peterson discovered that, "....the experiments we conducted show that motion pictures have definite, lasting effects on the social attitudes of children and that a number of pictures pertaining

to the same issue may have a cumulative effect on attitude."[54:66] The recent efforts of the various church organizations and social centers in censoring the commercial entertainment films is mute proof of the dangers of certain type films to the youth of this country.

Motion pictures frequently increase pupil's participation in classroom discussion and in other ways. Knowlton and Tilton in their experiments with history state that, "The increase in the total number of pupil participations attributable to the use of the photoplays was 10 per cent."[43:92] Although no statistics were available it is conceded by most teachers and librarians of schools and communities that the reading habits of pupils after seeing a particular film either in school or in the community increase tremendously and along the lines of interest depicted upon the screen.

Motion pictures, skillfully used, can promote good thinking. One of the common objections to films is that, although they may be valuable for factual or rote learning, they may interfere with good thinking. No research data support this claim. Whatever data exist refute it. Rulon gives the following conclusion founded on his experimental evidence. He says:

> Our results do not indicate any tendency for the motion picture technique to 'produce superficial thinkers', 'dull the imagination' (26:47), or to fill the child's mind with unrelated facts at the expense of his ability to think. On the contrary, when our tests were scored separately for Rote and Education Items, the film group excelled the control group by a larger margin on the Education Items than on the Rote Items. This finding is pronouneed in the Intermediate Test results and even more pronounced in the Retention results. (62:104)

The following also has the same vein of thought: "Our findings do not indicate that the motion picture presentation, when accompanied by good

classroom procedures tends in any way to cause the child to remember at the expense of stimulation of thought."[62:105]

The experienced teacher often finds, when testing a group after having taught a particular block of work, that many pupils have, in the process of learning, gathered together a conglomeration of distorted facts and ideas. The book on sale on bookstands which capitalizes on the so-called "boners" which occurred in classrooms or were found on examination papers is an example of the inaccuracies and misconceptions so often prevalent after a teaching exercise. Helen Caldwell Davis points out, "[18:110]

> The education film can perform a definite function in reducing the tendency to make inaccurate statements and include unnecessary facts. It increases the fund of correct information in the learning of certain types and as it does so perhaps reduces the need on the part of the child of making unnecessary or wrong statements in his effort to appear to know something. It gives definite and clear cut information of a certain type, and in doing so corrects misconceptions which the child may have acquired.

The final cogency for the use of films in education is provided by the conclusion of the Wood-Freeman study:[79:204]

> The results of the comprehensive and topical tests indicate that the experimental groups are superior to the control groups in both the indirect, interpretative outcomes of instruction, and in the immediate, concrete and direct outcomes; but the experimental superiority is much greater in the latter than in the former. The topical tests show that the experimental superiority in descriptive questions is notably greater than the superiority in explanatory questions. In view of the fact that this experiment lasted only twelve weeks, and since sound thinking ultimately depends upon concrete experience, these indications are highly favorable to the films.

It is not in the least surprising therefore that the growth of the motion picture habit within the school program has been in most instances rapid and indicative of continued increase in popularity. For

more than ten years motion pictures have made[17:5/]

> significant contributions to the educational programs of such cities as New York, Detroit, Pittsburgh, Philadelphia, Cleveland, Kansas City, St. Louis, Oakland, Berkeley, San Diego, Los Angeles and others. For example, here is the growth in the number of films used in large cities during the past few years: Chicago from 647 films in 1929-30 to 60,000 in 1935-36; Rochester from 5 a day in 1930 to 57 films a day in 1936; Buffalo from no 16 m m films in 1929 to 14,600 films in 1935-36.

Further proof of the rise in popularity is reflected in the following: in a survey of audio-visual equipment owned by elementary and secondary schools in the country in 1936 "a minimum of approximately 6,600--16 m m projectors and 3,600 35 m m were reported as actually owned by schools. Of these 800 were sound projectors."[47:63/] To say that the country is gradually awakening to the merits of the film is perhaps too harsh a statement, but it is apparent that there is now a decided trend throughout the land to utilize the motion picture in school programs. Teachers are investing in cameras and are making their own films. Universities and colleges are also producing many films, some for their private use and others that are made available to public schools. The Eastman Kodak Company and the Erpi Company have been and are still producing large numbers of films suitable for use in the classroom. It remains only for Hollywood with its vast resources to turn to the fertile field of educational films, and in so doing to guarantee a production list that would be certain to benefit every student in the country. New Jersey and Pennsylvania are pioneer states in providing visual aid courses in their Teacher Training Institutions.

Cooperative Film Libraries, with a nominal membership fee which allows use of a certain number of films throughout the school year, are being established in many cities throughout the country. The opportunity

to obtain the use of selected films by simply paying a membership fee and cost of mailing the films is indeed most attractive, and school administrators are gradually accepting this novel manner of providing films for their schools.

A question that still troubles school administrators is that of the type of projector to use. Shall the choice be for silent or sound "movies"? Devereaux contributes the following that should be of help to anyone who is undecided:[20:114]

> Talking pictures should not be used as an aid to instruction unless their use actually improves the efficiency of learning to a greater degree than is possible through any other means at comparable cost. If they effect an economy of time in learning or if they bring to the learner an enrichment of the curriculum not possible at comparable cost through any other medium, if they contribute materially to the development of those powers in the individual that are essentail in learning, if they are more effective than other teaching devices in establishing not only the direct and the indirect learnings but also the concomitant learnings, their use is justified by the teacher.

There is much that can be said for both the silent and the sound films as vehicles of instruction. Suffice to say that the silent type is cheaper, both in cost of projector and films, affords a larger variety of films to choose from, its projector is less complicated and therefore less likely to need repair, and that the room conditions under which the films can be shown need not be so stringent for the silent film in as much as accoustics need not be considered. On the other hand, the sound film not only appeals to the sight sensory organs, but to the auditory as well. A number of university tests have been made on the value of "talkies" for instruction. So far they all have pronounced the sound-picture presentation to be the most impressive of all teaching aids in education. Dr. Clark of New York University made a most interesting

study comparing sound films with silent films. His findings show:[12:31]

> The final percentages were obtained after photographing the classes during the showing of a number of different pictures, both silent and sound, and during lectures. They showed that, when watching sound film, 81.7 per cent of the students kept their eyes on the films. Of those watching silent films 75.2 per cent remained attentive while 54.6 of those listening to lectures were attentive.

So too, the works of Rulon and Arnspiger proved that sound is more efficacious than ordinary teaching methods. Hoban in his book summed up the general values of motion pictures in instruction without any particular differentiation of types of films employed, and lists the following statements:[31:258]

1. 10-35 per cent greater efficiency than old type teaching
2. Thought and reasoning are developed
3. The mastering of relationships
4. A permanence of learning
5. The developing of habits and skills
6. The developing of descriptive and explanatory responses
7. Developing the imagination
8. Developing interest

CHAPTER III

TEACHING WITH FILMS

Ever since the dawn of civilization man has been attempting to discover or devise more effective means and methods of acquiring and transmitting knowledge and skills. Always there have been limitations of one kind or another. The struggle has been the conquest of these limitations. The advent of the moving picture and its subsequent use in schools represents one of the greatest forward steps. Brunstetter very aptly states, "No individual lifetime can span more than a small part of the accumulated wisdom of the world."[8:5/] He also goes on to say that, "It is heartening to know that the development of the utilization of this potent device, the motion picture, is not to be haphazard, but it is to be accomplished through painstaking research in adapting the instrument to the objectives to be attained."[8:6/] General Science because of its very nature is one of the most popular subjects upon which films can be made. Because of its wide range of topics and its various phases of environment "movies" on the science subject have been made in greater numbers as compared with some of the other subjects in the school curriculum. Rulon writes, "General Science as a school subject would seem to be particularly amenable to instruction by motion picture."[62:32/] It would seem therefore that General Science is not only a fertile field for the making of moving pictures, it is a

subject which can profit much from the use of films as teaching aids in the classroom.

There is no set formula which expresses the exact way to teach a class where films are to be used. The procedure will vary according to the type of film used, the group with which one is working, the subject matter content, and the reason for showing the film. Films in general are used for the following purposes: to introduce a new subject, to conclude a subject, to review. Too often teachers have the attitude that to teach with a film merely means to project four to eight hundred feet of film on a screen and allow the pupils to watch it. Brunstetter most emphatically states that, "Teaching with films is not a matter of showing a picture to thirty or forty passive young observers and hoping that it has done its work; teaching with films is dynamic, interpretive, exploratory."[8:11] The challenge to the creative teacher appears not only in the film's clear and vivid presentation but in its flexibility of use which permits the accompanying learning activities of the group to be guided in almost any direction. One of the best definitions of teaching is that it "consists of placing the student in situations out of which the desired learning grows".[8:8] In creating this learning environment the teacher has to consider the child, the objectives, the subject matter, and the devices which will constitute the learning activities. The functions of the educational film are to present information, to mold attitudes and appreciations, and to stimulate interest. It must be realized now, however, that the film simply furnishes these functions; it rests upon the teacher to take advantage of them. It is the teacher alone who can make the showing of a film a real

learning exercise, or "effortless entertainment".[66:84]

Although, as has been said before, there is no set rule for teaching with films there are certain principles and guides that must be considered and followed if the showing is to be successful. It would not be burdening the good teacher with too much praise to say that a film in his hands would be much more likely to attain its purposes than the same film in the hands of a novice or poor teacher.

> The general criteria for good teaching apply of course to the film lesson--purposes clearly evident both to the teacher and to the pupils, a well organized attack upon the subject matter, activities which engage both individual and group interests, resourcefulness in turning unexpected situations to good account, and the like. (8:8)

It is clear that the modern dynamic conception of learning has forced the instructor to relinquish the role of one who merely passes on facts and skills to the pupil.

A suggested procedure for teaching with films would start with what Hoban calls "analysis of film content".[31:242] The purpose of this would be to discover its contents so that it could be related to the work of the group. This analysis would also serve to enable the teacher to pick out the important parts of the film and to fit the film in with the other teaching devices used by the group. It would also show not only the major objective of the film which of course it should have, but also the arrangement of titles, whether the scenes were in a logical and interesting order, the accuracy of the subject matter as well as its up-to-dateness. A most important aspect to consider in the film analysis is the probable effect of the film on the attitudes of the class. It goes without saying that if the film is one that is to be used for science it

should contribute to the scientific attitudes and should in no way tend to stir up prejudice or emotions. The quality of photography is important in that the artistic composition and perspective must be considered. If after the film analysis has been completed the film is found to be satisfactory, the next step should be pupil motivation and preparation. Ellis and Thornborough state, "The pupil must be prepared in advance for the use of materials."[26:161] The teacher should prepare a list of directing questions based on the subject matter content of the film and by means of these questions raise in the minds of his pupils other questions which will be answered by viewing the film. A pre-discussion centering around these questions will without fail develop an eagerness on the part of the pupil to see the film. It would also serve to make him aware of its significant aspects and further prepare him for a general understanding of the picture. To use the statement found in Motion Pictures in Education, "The class should be prepared in advance for the film and told what phase of the lesson the film will illustrate, so that it may know what to look for."[26:164]

No general rule can be made as to the number of times a film should be shown. Rulon advocates not more than two showings a day with a maximum of four showings for the entire study.[62:44] It is almost certain that unless the film is very unusual in its content four showings will cause unrest and general loss of attention. The average reel of film is 400 feet long, and usually one of these shown in a period is sufficient. Not more than 400 feet of film should be attempted for projection in one period of class time. However, there is little to

be gained in showing a film but once. Ellis and Thornborough say, "Show a film twice when possible and quizz between showings. A second showing will clear up incomplete impressions and permit pupils to observe details overlooked during the first showing."[26:169] In general, the number of showings depends upon the film's ability to make the showings purposeful in terms of the child's interest. A method of projecting film that is becoming increasingly popular is to show the film first in its entirety, and then repeat the showing to allow an opportunity for the class to break in or discuss at any time during the second showing. This so-called intermittent method gives the class an opportunity to take notes, ask questions, and to see any details missed in the first showing. It is wise to have some member of the class trained to operate the projector. Thus the teacher would be free to devote his entire attention to the more important matter of teaching. The final showing of the film should by no means signify the end of the lesson. A comparison of the tests given before the film was shown and after the final showing will help to determine the nature and amount of information each pupil has assimilated. It will show the failures as well as the successes and will point out whatever weaknesses exist either in the film content itself or in the points brought up for discussion. As a result of the film-showing the interests of the class will be heightened. The teacher must be ready and prepared to meet this new burst of enthusiasm so that there will be a continued study along the same line of work. This incentive can be provided if the teacher will suggest good reference books that will be enjoyed, certain places of interest that might be visited, projects that could be carried on at home, the world

of material that is available in museums. There are endless means of enriching the experience, and so round out the concomitant ideas that there will result a significant whole.

CHAPTER IV

AIMS OF GENERAL SCIENCE

The world today with its wealth of refinement is a scientific world and this is the scientific age for the people within its bounds. Science has broken down all barriers between people: the ignorant savage has seen the airplane, heard the radio, and marveled at the work of electricity. It is no longer a novelty for people to ride in an automobile or bus, to summon the owner of a house to the door by merely pushing a bell button, to thoroughly clean rugs with a vacuum cleaner, or to call the grocer by telephone. All these inventions and untold others were given to the world by science. How different is our life today from that quiet simple existence of the Pilgrim fathers. Imagine the reactions of one of these early settlers if he were suddenly to appear on one of our noisy, congested city streets! Would his behavior be so very different from that of the savage who was brought from the jungles to view life in New York City, and for the first time in his life saw city life and traffic, and actually cringed with fright while endeavoring to get away from it all?

What then should be the aims of General Science teaching? Primarily it would seem that one of the first aims in science teaching should be and is to provide the pupils with an appreciation of this scientific age and environment.[22:64] What boy or girl is not interested in the radio,

telephone, or airplane of today? It is then the mission of science "to develop such easily comprehended principles as to apply to the local environment".[25:65/]

Science has by no means reached its limit either in practical applications or in theories necessary to well-being. Secondly, it is the aim that science teaching make known to the pupils "the tremendous reservoir of new knowledge".[22:64/] This accumulated knowledge, if used properly, can be made to yield even greater scientific marvels. Here is a modern, up to date cold water faucet, shiny and resplendent, a far cry to be sure from the old oaken bucket of by-gone days; yet in spite of its efficiency, adaptability, and ingeniousness, it drips. Over head one of the latest type incandescent lamps suddenly glows brighter and then goes out. An automobile engine running smoothly and almost silently suddenly develops a "knock". There are countless other instances of modern up to date apparatus becoming faulty. There is always plenty of opportunity for improvement for the person who is interested and who cares to tackle the job.

Finally and equal in importance to the others mentioned is the need for scientific thought in this age of science. Scientific thinking is not an innovation to mankind "nor is it a new method that science has discovered".[22:73/] It is however, a method that lends itself ideally to the teaching of general science. It is as old as human intelligence. When man was face to face with what Dewey calls "a forked road situation" and thought the thing through to a solution of his difficulty instead of solving it in the old animal method of trial and error, he was using the scientific method. It is truly a common sense method of

thinking, and to be sure a commonplace one, but a check-up on the decisions made by individuals on important life problems tends to show that scientific thought was lacking in many of the decisions. One has only to listen to a rabid Democrat or Republican, question a few people as to the circumstances that gave them their life work to be satisfied that there was little or no scientific thought used in reaching a decision. "If science-teaching can habituate pupils to careful scientific thinking and points the way to carrying the habit over to the citizen it will do a great service to the individual and the nation."[22:76/]

Thus we find in the aims of science, that "exploration, guidance, adjustment, and stimulation"[27:41/] are the dominating ideas in junior high school instruction. It would be impossible however, and most unwise, to close these remarks on the general aims of science teaching without including the seven objectives of education: (1) health of the individual and of the community, (2) command of fundamental processes, (3) worthy home membership, (4) vocational guidance and preparation, (5) citizenship in a democracy, (6) worthy use of leisure, and (7) ethical character.[66:18/] Science must therefore try to do its part in producing a healthy individual, reasonably well prepared to handle the tools of education, capable of taking his part worthily in the home--"a morally upright citizen who will choose wisely his vocation and avocation".[22:81/] Hunter in his book points out the need of providing the pupil with those "needs, activities, and interests"[37:114/] that will permit him to establish himself in the society in which he will eventually find himself.

It would seem therefore that regardless of the number of aims

formulated, all authorities agree upon one general aim. They may couch it in various ways, but they all contain this central thought: it is to enable the pupil to adjust himself in the society of his fellow beings by means of an appreciation for and an understanding of his environment.[69]

CHAPTER V

METHODS OF GENERAL SCIENCE TEACHING

Historically the development of science teaching in the secondary school during the past three decades has been most interesting and significant. Thirty years ago science in the secondary school was much more of a replica of work done along the same line in universities than it is today.[37:12] The method of Agassiz, developed by the students of that great master in all the universities of the country, was being reproduced in the better secondary schools by a third generation of worshippers. Everywhere the laboratory played a primary part in the course, and the pupil was trained in techniques and methods similar to those used in the university. It is easy to see why teachers of science began to notice a decline in interest in their subjects. The entire method was ill adapted to the intelligence of a ninth-grade child. The laboratory was a place for busy work, for tasks not self-imposed but teacher imposed. The pupil became buried under a mass of many unimportant details. If he performed the required laboratory manipulations it was without any real purpose on his part. Motivation was lacking, for the pupil did not see his problems. The teacher, trained in a background of scientific data often failed to realize that the youngster did not have this much-needed background. What was logical to the teacher was chaos to the pupil, for young people do not approach their everyday problems by the logical method of the trained scientist,

but by bringing together many vague and partly defined concepts which are tested and applied in terms of their own knowledge, and finally built into what is to them a logical conclusion.

Much is heard today about the logical versus the psychological approach. No teacher can succeed without attaining the viewpoint of the pupil. It is necessary that each teacher remember how things looked when he was thirteen and to forget how these same things look now that he is thirty. In other words, if the teacher will view things from a student's point of view rather than his own there will be no difficulty in developing a method of attack for the lesson. It must be remembered that concepts grow and are not always brought to maturity in one lesson. Approached from this angle, the psychological becomes the logical. It must be remembered also that the emphasis in education today is on learning rather than teaching. It must be remembered too that learning is an active, not a passive process. As Dewey has so well demonstrated, pupils learn by doing. Scientists who teach scientific facts in hope that the pupils will use these facts in the discovery of scientific principles must realize that the chief aim should be stimulation of the learning process.

Henry C. Morrison has seized upon a very vital defect of modern school life, that of "satisfaction on the part of the pupil in part learning."[52:46/] In his text on the technique of learning in the secondary school, he has recognized the values of motivation and of apperception as well as the values that come through varied and abundant experiences. This is typical of modern thinking on teaching. The idea of the psychological unit although used by many teachers long

before the appearance of Morrison's text, is worthy of universal consideration by the science teacher. Pupils' interests are held only when the matter under discussion has some direct connection with the concepts that the pupils think worth while. The how and why of the unit is the attractive force that holds the pupils to the work in hand.

Learning on the part of the pupil is really a matter of adaptation, as Morrison points out. The successive steps of the learning process are adaptations in the same sense that certain acts in the development of living plants or animals are adaptations. When a pupil really comes to understand the principle which underlies the subject matter in his learning, he has made an adaptation. It is the business of school teachers to help the child to make the necessary adjustments to secure this complete learning. But adaptations become such only when they are really learned and become accepted as a necessary part of life. When a boy has once learned to swim, ride a bicycle, paddle a canoe, or cast a fly, that ability sticks with him no matter how long a time elapses between the last performance and the present one. It is this complete learning that education seeks but as yet has failed in a large number of instances to obtain. It suggests fewer units better done.

One of the greatest aids in learning is the scientific method. It is accepted today by science authorities that "science is not only subject matter but a method".[22:53] To many it has been shorn of its title and simply called common sense thinking. If for example a class were asked a question such as, "Which could hold more water, a bucket of small sized stones or the same size bucket filled with large rocks?",

and the responses were a series of weird guesses without true thought or reason, this would be an example not of the scientific method of thinking but of plain guesswork. On the other hand, if the group reasoned that the problem could easily be solved by actually making both tests and thereby arrive at a sound conclusion, the scientific method would have been the means of solving their problem. Eikenberry lists the following distinguishing characteristics of this method:[25:76/]

a. "There can be no scientific thinking without a problem.

b. "Careful and extensive observation is resorted to for the purpose of defining the problem and supplying the basis for suggestions related to the problem.

c. "The tendency to escape from intellectual uncertainty by immediate acceptance of the first suggestion is inhibited, and alternative suggestions are sought, including as far as possible all plausible suggestions.

d. "Each suggestion is examined in turn both by following to its ultimate meaning and by reasoning back from the suggested meaning to the facts either observed or implied.

e. "The selected suggestion or suggestions are submitted to the test of further observation or experiment to establish finally the validity of one of them which is accepted as the conclusion."

General Science is to be interpreted as a method of developing the habit of scientific thinking and securing scientific information through the investigation of a series of real problems.

Many teachers have found special techniques in which they believe and special devices which they have tried with success. Some of them have even experimented with different kinds of methods and have made crude measurements of the results obtained by use of these various methods. Much discussion today is evoked over the relative values of the demonstration and the individual experiment. Frank has this to

say:[27:80]

> The lecture demonstration deserves a prominent place in our methods of teaching General Science. If properly handled, this is the most economical and efficient method for imparting many of the understandings which are necessary, and for developing appreciations and powers of observation.

Among the methods listed by Eikenberry [25:70-94] are the lecture method, the question-answer method, the textbook method, the object-study method, the picture method, the observation method, the experiment method, the laboratory method, the problem method, the "Hueristic method," the project method and finally the unit method. The above list shows clearly that the writer has no fundamental view on methods of teaching. He has not listed methods at all, but simply minor techniques that may be used by the competent teacher as he strives for the major techniques of the teaching method. Arbitrarily listing these minor techniques and calling them methods does not in itself signify that they are methods because no mention has been made of the nature of the subject-matter, the nature of the child, or the nature of our democratic society which are the three most important determiners of method and must be considered before any definite method can be selected for use in presenting a unit of work.

When we come to consider methods in any subject the logical first step is to set forth the aims or purposes of the subject. The distinctive aims or purposes of General Science are:

1. To lead the child to appreciate the progress of science and the place of science in making the modern world a different world.

2. To lead the child to think through and understand simple problems connected with the home, farm, and industry, such as the way the radio

> works, how to adjust or repair it; or the reason for storm windows in winter; or the idea behind a "booster coil" in a hot water furnace.

Once the aims or purposes have been established the next step is to decide by what methods or major techniques are these aims best accomplished. From the standpoint of general understanding and enjoyment General Science is an appreciation subject and as such, certain phases of its subject matter must be taught by use of the major technique appreciation. A trip to a modern broadcasting station where the pupils are allowed to go behind the scenes and watch the operation of one of the scientific means of communication helps the child to appreciate the importance of science in general and of the radio in particular. This illustrates the unit worked out as an appreciation unit.

General Science in so far as it helps to understand and solve practical problems about the home and community is a problem subject with the problem as the major technique. The work of the electric fuse in the home, its importance as a safety factor, and the dangers resulting from it if used improperly--such as inserting a cent when a fuse has blown--is a phase of subject matter that can be best solved by means of the problem technique. The radio, its principle, construction, and functions, raises a problem that can be solved only by the problem technique. The installation of an electric lighting system on a farm is a problem which would necessitate a knowledge of the buying of the equipment, the motive power, whether by windmill or gasoline engine, the subsequent repairs, the storage batteries for emergencies, the wiring of the building and the servicing of the plant after installation.

This problem is well suited to the problem technique.

There is no essential drill in General Science nor are there any projects, therefore, these two major techniques do not apply to General Science. Both of these treatments would be questioned by the person not fairly trained in the field of method. The average teacher wants to drill on facts, but drill is properly applied to material that is used regularly, one might say daily. This criterion of daily usage is not properly met by any of the facts in General Science.[77:8-9] Some teachers would call the making of a radio set a project, but it does not have the essential vocational-training elements of a true project.[77:74] Hence, of the four major techniques: appreciation, the problem, drill, and the project, only the first two are applicable to the teaching of General Science.

The minor techniques such as assignments, questioning, supervised study, reviews, examinations, and films are subordinate to the major techniques and must aid in carrying out the same. For example, films in a science classroom may serve as an aid to either or both of the major techniques depending upon the subject matter. In the case of the minor technique "questioning," the type of question should be governed by the major technique used whether it be appreciation or the problem. Problem questioning means thought-provoking questions of large scope, while, on the other hand, appreciation questioning may mean simply an opportunity of expresing a preference or making a choice.

Today the child or pupil is recognized as the nucleus around which all instruction is centered. No longer should instruction be meted out solely because the teacher is fond of it, but rather it should be

organized in terms of the needs, interests, and activities of the pupil. "The nature of the child determines more or less the subjective procedure,"[76:6] in the classroom, and this procedure will differ with individuals because no two pupils are alike mentally and there will be in every class individual differences which must be considered. However, the general laws of learning and the general laws of response must be made to function also. The laws are the law of interest, law of readiness, law of attention, law of association, law of use (and disuse), and law of success. They indicate more or less the nature of the appeal which must be made. The law of interest should be the first to be considered in any situation and should be utilized as a means of motivation for all procedures.

The third and final determiner of method, the nature of our democratic society, is one that has its roots firmly imbedded in the aim of education today. The turbulent conditions within the boundaries of our democracy today demand that the schools democratize their education. This can be done only if the teachers of the classrooms can and will develop the spirit of cooperation among the members of the class.

CHAPTER VI

THE EXPERIMENT

Purpose of the Experiment

Every year throughout the country there are graduated from teachers' colleges, teacher training institutes, colleges, and universities thousands of students intent upon starting their careers as teachers. Many of these beginners in the teaching field will be called upon to teach General Science, especially in the junior high schools. Some of the graduates will have been fortunate enough to have had a period of practice teaching while in college; many, however, will have been graduated from colleges or universities where no such opportunities are afforded. Should those students who did have practice teaching desire to specialize in General Science it would of course be one of the subjects that they would be permitted to observe and teach. On the other hand there are many student teachers who observed and taught subjects other than General Science, such as mathematics, the social sciences, English, and the languages, who find that upon graduation they must teach General Science in either the grades or in junior high schools. Then too there are those individuals who attended or were graduated from institutions other than teacher training schools who obtain positions in the teaching field even though they may have had no actual experience along that line. Consideration must be made

also for those teachers in the service who are demoted, promoted or transferred each year and as a result may be called upon to teach subjects that they have not taught before, or have not taught for several years. General Science, because it is an established part of the curriculum of most junior high schools,[66:194] is often allotted to one of these teachers with the result that the teacher, regardless of how efficient he may be in his own field, must take valuable time (his and the pupils') to orient himself to the new program if he has not taught it before. In the event that he has previously taught science he must acclimate himself to a modern, up-to-date presentation of the old once-familiar subject matter. There is, finally, a group of teachers, an exceedingly large group too, who have taught for years either in the same place or in various communities, who may be classified as self-satisfied pedagogues. These teachers, not spurred on by any particular administrative pressure or outside interference, are perfectly content to go along teaching in the same old way, using the same age-old methods, year in and year out. They are ploughing along in educational ruts that are so deep that it is difficult for them to observe the beauty of the green fields of modern practices in education that border their own narrow paths.

The purpose then of this experiment is to help those teachers, young and old, who find themselves teaching General Science for the first time, to stimulate those teachers who are now teaching the subject but with antiquated methods, and most of all to serve both as an aid and an inspiration to the novice who has chosen teaching as a

career. It was for those groups that a detailed account of all the phases and experiences of the experiment was carefully recorded. Obstacles as well as successes are mentioned to point the way for anyone attempting a similar project. A complete set of lesson plans for both the film group and the non-film group should be of value to the interested teacher. The subject matter with evaluation as well as its allocation could and should be utilized by the teacher of General Science today. From the results obtained in this experiment as carried out, it is the hope that, through making it possible for the new teacher to follow the plans for one complete unit in the program of science as shown in this report, other units of General Science could be treated in the same manner and with similar results.

It is thus evident at the outset that the purpose of this work was not to show the advantages of the motion picture in teaching a unit in General Science, but rather to show a modern method of presenting a unit of work. To be sure the results are important, and will continue to be until our present philosophy, that of stressing subject matter, has changed. But, in as much as the success of teaching subjects by films, whether those subjects be history 66:194/ or science, 66:194/ has been proved most convincingly by Knowlton and Tilton, 43:184/ by Rulon, 62:98/ Clark 11/ and Westfall, 75:114/ there would be little to gain in conducting another such experiment to prove again merely what has been proved already.

The education of our youth presents a many-sided problem, and if the material found incorporated in these pages will serve to guide,

stimulate, enlighten, and assist those attempting to solve this great time-worn problem, then indeed this experiment will have served its purpose.

Description of the Experiment

Use was made of the entire ninth grade of the junior high school in carrying out the experiment, since in this particular school General Science is a required subject for all pupils. That meant that 330 pupils, grouped into 10 classes, took part in the experiment. All classes were heterogeneously grouped as far as possible although the ability and achievement of certain groups surpassed that of others. The teaching was done by two of the regular members of the faculty, each on a par with the other in teaching experience and training. Each teacher taught five of the groups five periods a week, each period 50 minutes long, making a total of 250 minutes weekly. In all the classes, the entire work was covered in the classroom since no outside work or home work was required.

A complete unit in General Science, "weather" was chosen to be used as the teaching material. The time allotted to cover this unit was two full weeks or 10 consecutive teaching days. The complete unit "weather" was divided into four main topics: atmospheric pressure, the water cycle, climate, and weather forecasting.

The general plan was to have the first main topic taught by one instructor in the regular manner to a group of pupils who would be called the "non-film group". At the same time another group called the "film group" were being taught the same topic by a different

instructor who used a film instead of a textbook. The second main topic was treated in exactly the same way. With the two remaining topics the procedure was reversed. The non-film group became the film group and the film group became the non-film. The teachers kept the same classes throughout the entire time; each taught two topics with the use of textbooks and two topics with the use of films. A chart may serve to elucidate.

Teacher	Film Groups	Non-Film Groups
Mr. X	Atmospheric Pressure	Climate
	Water Cycle	Weather Forecasting
Mr. Y	Climate	Atmospheric Pressure
	Weather Forecasting	Water Cycle

Chart 3.

In other words, while Mr. X was teaching his groups the topic "atmospheric pressure" with a film, Mr. Y was teaching his groups the same topic using a textbook instead of the film. Each of the four topics was handled in this same manner to insure continuity of subject matter.

Four tests were prepared by the two teachers with the able supervision of the principal. Each test comprised twenty-five questions of the multiple choice type, and was based on one of the four main

topics of the unit "weather". These tests served as the pre-test as well as the final test; that is, each test was administered to each group twice, once before the teaching began and again when the teaching had been completed.[78:16/] By using the tests as pre-tests it was possible to learn the individual weaknesses before actual teaching had begun, and thus plan the work in such a way that they would be considered.

The groups were equated in a very simple but effective manner (Dr. Guy Wilson). Scores of both the pre-tests and final tests were recorded and tabulated for both film and non-film groups. All the scores, both pre-test and final test, made by all the film groups, including the classes of both teachers, were compared. So too were the scores of the pre-tests and tests for the non-film groups of both teachers. The accompanying table shows how this method was worked out and will serve to clarify the foregoing statements.

Table 1. Equation of class groups, showing for the film groups and non-film groups the scores made on the pre-tests and final tests in the four topics studied.

	FILM								NON-FILM							
% Score	X Atmos. Pre T	X Atmos. Test T	X Wat.Cy Pre T	X Wat.Cy Test T	Y Clim. Pre T	Y Clim. Test T	Y Wea. Fore. Pre T	Y Wea. Fore. Test T	X Clim. Pre T	X Clim. Test T	X Wea. Fore. Pre T	X Wea. Fore. Test T	Y Atmos. P. Pre T	Y Atmos. P. Test T	Y Wat.Cy Pre T	Y Wat.Cy Test T
(1)	(2)		(3)		(4)		(5)		(6)		(7)		(8)		(9)	
100	0	0	0	1			0	0								
96	0	8	0	2	0	2	0	3		2		2		1		
92	1	12	0	13	0	5	0	13	1	5		4		4		
88	1	23	0	25	0	17	0	19	2	12		8	1	8		1

Table 1. (concluded)

	FILM								NON-FILM							
% Score	X atmos. Pre T	X atmos. Test	X Wat.Cy Pre T	X Wat.Cy Test	Y Clim. Pre T	Y Clim. Test	Y Wea. Fore. Pre T	Y Wea. Fore. Test	X Clim. Pre T	X Clim. Test	X Wea. Fore. Pre T	X Wea. Fore. Test	Y Atmos. P. Pre T	Y Atmos. P. Test	Y Wat.Cy Pre T	Y Wat.Cy Test
(1)	(2)		(3)		(4)		(5)		(6)		(7)		(8)		(9)	
84	2	26	1	35	0	20	0	22		14		9	1	9		2
80	2	19	1	18	2	22	1	27	5	18		18	6	15	2	7
76	8	23	3	18	4	33	0	24	10	22	1	22	12	18	7	10
72	7	20	8	17	9	36	4	27	8	28	2	22	11	23	8	19
68	10	13	11	10	13	15	6	9	11	23	7	24	14	19	11	20
64	25	7	13	9	16	4	18	5	20	10	6	16	11	20	10	25
60	24	5	11	9	23	3	16	4	27	10	15	18	18	13	20	26
56	14	5	18	4	21	2	19	0	19	10	18	9	16	11	20	11
52	22	1	17	3	14	1	25	0	25	9	25	5	16	5	23	8
48	21	1	22	2	11	0	15	0	13	1	22	3	11	4	12	7
44	7	1	23	1	16	0	12	0	13	3	24	2	11	1	10	12
40	6	0	15	0	12	0	13	0	4	1	16	1	7	2	10	4
36	6	0	12	1	9	0	12	0	4	1	14	1	5		11	5
32	6	0	5	0	3	0	8	0	4		5	1	5		6	
28	1	0	5	0	5	0	3	0	3	1	5	1	4		2	1
24			3	0	1	0	0	0			2		3		3	
20					1	0	1	0	1		1		1		2	
16	1	0									3				1	
Total	164		168		160		153		170		166		153		158	
Med.	56	80	48	80	56	76	52	80	56	72	48	72	56	72	52	64

Technique employed.-- The pupils in the control groups were taught by the ordinary classroom methods without the aid of motion pictures. They were allowed, however, to use all pedogogical devices that the teacher could bring into the classroom and that were pertinent to the topic, with the single exception of the motion picture. Maps, charts, pictures, globes, diagrams, models, and the opague and lantern slide projectors were freely used by this group. The teacher of the control groups was urged to carry on all class activity in a normal and natural manner. The pupils did not know at any time that an experiment was being carried on. The pupils of the experimental group were presented with two showings of each film during the regular class periods. They viewed the film first in its entirety; then on the second showing the "stop and go" method was used. With this method the film was stopped at any time, reversed for some particular point in question, or used as a still picture for some other reason.

The content of the films used in this experiment covered those important elements of subject matter selected from the four major topics of the basic unit "weather". These, it was felt, were particularly well adapted to presentation through the medium of the motion picture, any available teaching devices, with the production techniques inherent in the silent film also considered. Other criteria which guided the selection of the films is presented in another section under the title "Selection of Films".

Tests were constructed from the unit of instruction, namely, "weather". Those elements of subject matter which were considered

important by the science specialists who compiled the various textbooks from which the subject matter was obtained, were used as the basis for the tests. From these items the multiple-choice type of test was prepared by the teachers of the two groups. This type of test was selected to avoid confusion and required the checking and underlining of one of three responses which correctly completed a given statement. Examples of these tests are found in another section.

Four tests were constructed, one for each of the four main topics included in the unit. Each test consisted of twenty-five questions of the multiple-choice type. These tests were administered to the entire group of control and experimental classes before any teaching had taken place. The object of this pre-test for all pupils was to discover their present knowledge of the subject, to uncover any known weaknesses in certain phases of the work, and to strike out any questions that were either too easy or too hard for the group. The same test was repeated after the pupils had studied each major section of the unit. This was the final test administered and was used as the basis of marking as well as comparing one group with another.

The tests, both pre-test and final, were scored by the teachers of the groups. An objective key was used for scoring all tests. The fact that each question had to be checked as well as underlined served to increase the general accuracy in correcting. The accuracy of scoring was further insured by allowing pupils to inspect their papers after the results had been recorded.

Teaching procedure for the control group.-- The length of time allotted for actual teaching was five days or 250 minutes divided into five class periods. A plan of the subject matter was available to the teacher and was carried out in the following manner:

I. Introductory talk by the teacher

   A. 5-7 minutes to introduce the topic and raise questions

II. Supervised study

   A. Pupils given time to investigate questions that were raised
   B. Suggested readings and activities offered to pupils
   C. An explanation of the best method of study

III. Discussion

   A. Demonstrations of subject matter
   B. Results of study

IV. Supplementary work

   A. Inside classroom
   B. Outside activities

V. Evaluation

   A. Multiple choice test at conclusion of the main topic

VI. Application

   A. Association with environment

Teaching procedure for the experimental group.-- The time allotment for this group was the same as that allowed for the control group, five teaching periods of approximately 50 minutes. The procedure differed of course from that outlined for the control group. The procedure was:

I. Introductory talk by teacher

A. Over-view of film - use of directing questions

II. Presentation of film

A. Complete continuous showing of film

III. Discussion

A. Answers to directing questions
B. Suggested activities and readings

IV. Film review

A. Intermittent method of showing film

V. Discussion

VI. Evaluation

A. Multiple-choice test at completion of topic

VII. Application

A. Association with environment

Selection of Subject Matter

The unit weather was chosen as the topic for the experiment principally because there would be a psychological time to present such a block of work. Winter and spring are the two seasons of the year that provoke the greatest amount of interest in the weather conditions from day to day. It was the plan to present the material during the closing days of winter with the coming of spring near enough in the offing to stimulate the seasonal interests of the pupils.

The subject-content to be covered in the unit was not restricted to one book, although a basic text was used throughout the experiment. It was the consensus of opinion of the administrators and science

teachers that the subject matter covered should be the latest and best material available not from any one textbook but from a survey of the outstanding general science textbooks in the field today. This was done by using the material in the basic textbook as the nucleus, and then adding to this the material gathered from the various textbooks examined. There were 18 general science textbooks used for this survey of subject matter, not including the basic text of the grade. A study of the accompanying chart will clarify the method of selection. It is apparent, after an examination of the chart, that the range of topics found under the general title "weather" is indeed wide, and that the majority of textbooks agreed on certain topics, whereas other topics were found only in one or a few of the total number of books. It was a comparatively simple procedure to list the topics that were common to the majority of science texts. Those topics were the ones selected for the subject matter to be taught in the experiment. If the authors of a majority of the texts could agree on certain topics and considered them important enough to be used in their textbooks, the choice of these topics for the experiment should provide the pupils with the best possible conception of the topic "weather".

	A	B	C	D	E	F	G	H	I	J	K	L	M	N	O	P	Q	R
Weather Signs									x			x	x				x	

Chart 4. A list of all the topics on weather taken from 18 science books consulted and represented on the chart by letters. The letters correspond to the books listed under "Sources of Subject Matter". The frequency of the topics is shown by crosses.

	A	B	C	D	E	F	G	H	I	J	K	L	M	N	O	P	Q	R
Temperature	x		x		x	x	x	x	x	x	x	x	x	x	x	x	x	x
Angle of rays	x		x		x	x			x		x		x	x	x		x	
Absorption by surface	x		x		x	x			x		x	x	x	x	x		x	x
Topography	x		x		x	x			x			x	x		x		x	
Mountain ranges		x	x		x	x			x				x	x	x		x	
Thermometers	x		x			x				x		x			x	x	x	x
Thermograph	x				x	x	x					x		x	x			
Barograph	x	x			x		x		x		x		x		x		x	
Temperature & air pressure	x	x			x	x					x		x		x		x	
Barometer	x	x				x		x	x			x	x		x	x		
Humidity	x	x	x	x	x	x	x	x		x	x	x	x	x	x	x	x	
Relative humidity	x	x	x				x	x		x	x	x	x	x	x	x		
Causes of -	x	x				x	x	x		x	x		x	x	x	x	x	
Hygrometer	x	x	x		x		x	x		x			x	x	x		x	
Table of humidity	x	x					x	x		x	x		x	x	x			
Evaporation	x			x	x	x	x					x		x	x			
Importance to life												x						
Perspiration												x						
Temperature, Air Pressure, Humidity	x	x				x				x	x				x	x		
Relation of -	x					x				x				x		x		
Wind, cool air		x	x	x	x		x	x	x	x	x	x	x	x	x	x	x	x
Air Currents & Evaporation	x													x				x
Warm air vs. cold air	x		x	x	x	x	x				x			x	x	x	x	
Damp air vs. dry air	x		x	x		x					x	x		x	x	x	x	
Winds	x		x	x	x	x	x	x	x	x	x	x	x	x	x	x	x	
Rates of evaporation	x			x			x							x				
Condensation	x			x	x	x	x			x		x	x	x	x		x	x
Definition	x			x		x	x			x		x	x	x	x		x	x
Dew forming	x		x	x	x	x	x	x		x	x		x	x	x	x	x	x

Chart 4. (Continued)

Boston University
School of Education
Library

	A	B	C	D	E	F	G	H	I	J	K	L	M	N	O	P	Q	R
Frost	x		x	x	x	x	x	x		x	x		x	x	x	x	x	x
Fog - mist	x		x	x	x					x	x	x		x	x	x	x	x
Hail	x					x		x		x			x	x	x	x	x	x
Rain	x	x	x	x	x	x	x	x	x	x		x	x	x	x	x	x	x
Snow	x			x	x	x		x		x		x	x	x	x	x	x	
Sleet	x	x	x	x	x	x	x	x	x	x		x	x		x	x	x	
Clouds	x	x	x	x	x	x	x	x		x	x	x	x	x	x	x	x	x
Dust and ice																		
Types				x	x	x	x	x			x	x	x					
Cirrus	x			x	x	x	x	x			x	x	x		x			
Stratus	x			x	x	x	x	x			x	x	x		x			
Cumulus	x			x	x	x	x	x			x	x	x		x			
Nimbus	x			x	x	x	x	x			x	x	x		x			
Combinations	x			x		x									x			
Weather Defined	x	x	x	x	x	x	x	x		x	x	x	x		x			
Law of cause & effect																		
Local Storms															x			
Thunderstorms	x		x	x	x	x	x	x	x	x	x	x			x	x	x	x
Lightning			x			x	x								x			x
Danger places	x																	
Importance of Rainfall				x							x	x	x					
To man and world																		
Tornadoes	x		x		x	x	x	x	x	x	x	x	x	x	x		x	x
Described	x		x					x	x			x		x	x		x	
Cyclones & Anti-cyclones	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x
Storm areas						x	x	x				x			x	x	x	x
Northerm hemisphere cyclones								x				x			x	x	x	

Chart 4. (Continued)

	A	B	C	D	E	F	G	H	I	J	K	L	M	N	O	P	Q	R
Storm Paths in the United States	x	x		x	x				x	x				x	x	x	x	
Characteristics	x													x	x			
Climate		x			x	x	x	x						x	x			x
Defined		x	x			x		x		x		x	x	x	x			
Plant life in world			x			x		x		x		x	x	x	x			x
Animals						x				x		x		x				x
Description of animals																		
Industry			x			x	x	x		x		x	x	x				x
Fruit raising Cotton Frigid zones																		
Occupations			x		x	x	x	x		x		x	x	x				x
Health			x		x		x	x				x	x	x				x
Weather bureau	x			x			x	x	x		x	x	x	x	x	x	x	x
Story of barometer	x					x									x	x		
Mercury	x	x			x	x				x						x		
Aneroid	x	x					x						x			x		
Anemometer	x	x			x		x	x					x		x	x	x	
Sunshine recorder	x																x	
Rain gauge	x	x				x		x			x		x		x		x	
Weather forecasting	x			x	x	x	x	x	x	x	x			x	x	x	x	x
Weather maps	x		x		x	x	x	x	x		x	x	x	x	x		x	x
Layers of atmosphers	x																	
Amount of heat given off by earth	x																	
Fighting frost	x																	
Hurricanes	x																	
Weighing air		x				x												
Changes in pressure of water & air		x																
Air pressure		x																
Pressure in all directions		x																
Compressed air		x																

Chart 4. (Continued)

	A	B	C	D	E	F	G	H	I	J	K	L	M	N	O	P	Q	R
Siphon		x																
Other uses of air pressure		x																
Measuring altitude with barometer	x	x																
Altimeter		x																
Composition of air		x																
Highs and lows	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x
Trade winds	x					x				x		x	x		x		x	x
Doldrums		x			x			x				x	x		x			
Land & sea breeges			x	x		x			x			x	x		x		x	x
Water cycle	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x
Cloud bursts												x						
Effects of bodies of water on climate		x	x				x		x			x			x			x
Zones							x						x		x			x
Belt of calms													x		x			x
Prevailing westerlies	x		x	x	x		x	x		x		x	x		x		x	x
Waterspouts													x					

Chart 4. (Concluded)

The organization of this material required a considerable amount of planning and adjusting to attain the proper arrangement of materials in the order best suited to the needs of the class and at the same time have it so arranged that it could be correlated most effectively with the subject matter portrayed in the films. This liberty of rearranging the subject matter so it would be satisfactory was taken because after a thorough study of the selected 18 textbooks in the field of General Science, no established order could be found. A check of the page numbers in the reference list of the 18 books used in the survey shows a decided lack of uniformity in arrangement. Some authors placed the topic "weather" in the early part of their book, others left it for the end, with a number of authors choosing to cover the topic in the middle range between the two.

Reference List 1. "Sources of Subject Matter"--the 18 books consulted to determine the frequency of weather topics.

A. Bowden, G. A., Foundations of Science, Blakiston's Sons, Philadelphia, Pennsylvania, 1931.

B. Caldwell and Curtis, Introduction to Science, Ginn and Company, Boston, Massachusetts, 1930.

C. Clement, Collister, Thurston, Our Surroundings, Iroquois Publishing Company, Syracuse, New York, 1934.

D. Davis and Sharpe, Science, Henry Holt & Company, New York, New York, 1936, p. 94-116.

E. Hessler, John C., The First Year of Science, Benjamin H. Sanborn Company, Boston, Massachusetts, 1925, p. 157-179.

F. Hunter and Whitman, Science in Our World of Progress, American Book Company, Boston, Massachusetts, 1934, p. 531-536.

G. Jean, Harrah, Herman, Powers, Man and the Nature of His Physical Universe, Ginn and Company, Boston, Massachusetts, 1934, p. 389-419.

H. Lake, Harley, Welton, Exploring the World of Science, Silver, Burdett and Company, Boston, Massachusetts, 1934, p. 116-156.

I. Piper and Beauchamp, Everyday Problems in Science, Scott, Foresman, and Company, New York, New York, 1933, p. 90-123.

J. Pulvermacher and Vosburgh, The World About Us, D. C. Heath Company, Boston, Massachusetts, 1930, p. 76-106.

K. Regenstein and Teeters, Science at Work, Rand McNally Company, New York, New York, 1935, p. 462-509.

L. Skilling, W. T., Tours Through the World of Science, McGraw, Hill Book Company, New York, New York, 1933, p. 74-136.

M. Snyder, William H., General Science, Allyn and Bacon, Boston, Massachusetts, 1925, p. 265-292.

N. Trafton and Smith, Science in Daily Life, J. B. Lippincott Company, Philadelphia, Pennsylvania, 1936, p. 82-112.

O. Van Buskirk, Smith, Nourse, The Science of Everyday Life, Houghton, Mifflin Company, Boston, Massachusetts, 1930, p. 137-165.

P. Watkins and Bedell, General Science for Today, MacMillan Company, Boston, Massachusetts, 1936, p. 25-45.

Reference List 1. (concluded)

Q. Webb and Didcoct, Early Steps in Science, D. Appleton & Company, New York, New York, 1927, p. 360-404.

R. Weed, Rexford, Carroll, Useful Science for High School, John C. Winston Company, Philadelphia, Pennsylvania, 1935, p. 626-645.

Basic Text Wood and Carpenter, Our Environment: How We Use and Control It, Allyn, Bacon Company, Boston, Massachusetts, 1934, p. 547-570.

It was necessary therefore first to become fully acquainted with films to be used in part of the experiment, and the subject matter they covered in order to discover: (1) if they contained the correct subject matter as based on the survey, and (2) just how this subject matter was distributed throughout the films. This done, it was possible to arrange the survey material in four groups, each group corresponding to the subject matter contained in one of the films. These groups with the matching films appear in the following digest:

Digest 1. Subject Matter and Films to Match.

Subject Matter	Film
I. Atmospheric Pressure	Atmospheric Pressure
A. Causes	
1. Layers of atmosphere	
2. Unequal heating	
a. warm and cold air	
3. Water vapor	
a. wet and dry air	

Digest 1. (continued)

Subject Matter	Film
4. Altitude	
a. topography	
B. Measurement	
1. Barometers	
a. mercury - construction	
b. aneroid - construction	
c. barograph	
II. The Water Cycle	The Water Cycle
A. Evaporation	
1. Rates of	
2. Significance of	
B. Condensation	
1. Cause	
2. Types	
a. clouds	
1. types of	
a. cirrus, cumulus, stratus, nimbus	
C. Precipitation	
1. Dew	
a. explanation of dew-point	
2. Frost	
3. Fog and mist	
4. Rain	
5. Snow	
6. Hail	
7. Sleet	

Digest 1. (continued)

Subject Matter	Film
D. Humidity	
1. Effects	
a. personal feelings	
b. weather	
2. Measurement	
a. hygrometer - wet and dry bulb	
b. whirling psychrometer	
c. relative humidity table	
III. Climate	Climate
A. Relation to weather	
1. Zones of the earth	
a. temperature	
1. causes for variations	
a. angle of sun's rays	
b. surface absorption	
c. topography	
d. influence of mountain ranges	
e. presence of bodies of water	
2. measurement	
a. thermometers	
b. thermograph	
B. Influence on mankind	
1. Peoples and occupations	
2. Plants and animals	
3. Industry and education	

Digest 1. (concluded)

Subject Matter	Film
4. Health and habits	
5. Shipping and aviation	
IV. Weather Forecasting	Weather Forecasting
A. Weather defined	
B. Air currents	
1. Trades and anti-trades	
2. Prevailing westerlies	
a. storm paths in U.S.	
1. cyclones and anti-cyclones	
3. Tornadoes - hurricanes	
4. Local storms	
a. thunder storms	
5. Measurement of wind	
a. anemometer	
C. U.S. weather bureau	
1. Organization	
2. Weather maps	
a. highs - lows	
b. iso-bars and iso-therms	
c. interpretation of	
D. Other agencies	
1. Radio	
2. Newspapers	
3. Observatories	
4. Weather stations	

Generalizations:— An aim of education that seems consistent with the postulations of modern philosophy is, "Life enrichment through participation in a democratic social order."[66:42] This enrichment must come by means of a planned program of education that will provide experiences and learnings that will contribute as much as possible to the attainment of life enrichment. General Science as a part of the program of education must do its share in providing the experiences necessary for at least a partial fulfillment of the goal. Life enrichment is in a large way attained by an understanding of the principles and generalizations that ramify into human experience. The understanding of principles and generalizations comes from the association of ideas that are developed from experiences. "The principles and generalizations that ramify most widely into human affairs may be stated as objectives of science education."[66:43]

The choice of generalizations was determined by the usefulness of the extent to which they touch the interests and relate to the welfare of human beings. A definition of these generalizations comes from the writings of men of science, with particular attention being paid to the material they wrote for general readers. The search was fruitful in its results since the writings were the result of careful thought which concerned the needs and interests of the general or unspecialized reader, and represents the effort to meet these needs by men who have had training, experience and knowledge sufficient for them to capably survey the fields in which they write.

A characteristic of this age is the challenge that it carries to think clearly about facts associated with the control of energy,

control of the causes of ill-health, metereological phenomena, heredity, natural and artificial selection, cosmic and biological evolution, time, space, life processes, chemical changes, gravitation, machinery, and the nature of matter. These are the considerations that greatly influence the activities of the people of today. Since this is so, then it is upon the school that the duty is devolved to provide its pupils with a program that will endeavor to furnish at least a minimum of orientation with respect to these influences. "Those principles common to a large number of occupations would indicate what are the most desirable ones to include in the public-school science course."22:95/

The Thirty-First Year Book 66:53-54/ lists 38 of the major generalizations for use in teaching General Science, and from these 38 the following were selected as objectives for the teaching of the unit "weather".

1. The sun is the chief source of energy for the earth.

2. The earth's position in relation to the sun and moon is a determining factor of life on earth.

3. Matter and energy cannot be created or destroyed, but may be changed from one form to another.

4. There have been profound changes in the climate, not only of certain regions, but also of the earth as a whole.

5. Chemical and physical changes are manifestations of energy changes.

6. Every substance is one of the following: (a) a chemical element, (b) a chemical compound, (c) a mechanical mixture.

7. Certain material substances and certain physical conditions are limiting factors to life.

8. The gravitational attraction between the earth and a mass of unconfined gas or liquid causes the pressure of the liquid or gas on the surface of the earth.

9. Distances in space seem extremely vast when compared with distances on the earth.

10. The physical environment has great influence on the structural forms of life and on plant and animal habitats.

11. Liquid or gas pressure is exerted equally in all directions.

12. Radiant energy travels in straight lines through a uniform medium.

13. In a chemical change a quantitative relationship exists between the amounts of substances reacting and the amounts of the substances that are the products of the reaction.

14. Chemical changes are accompanied by energy changes.

Selection of Films

The films used in this experiment were selected after a thorough and intensive study had been made of all the available lists of educational pictures. The 16 m m silent type of film was selected for use because the equipment of the school in which the experiment was to be carried out necessitated this particular size and type. To obtain the lists of films available for use in public schools it was necessary to send out a form letter to one hundred film producers, distributors, film libraries, educational agencies, and the various United States Departments. The names and addresses of these individuals, companies, libraries, agencies, and departments were obtained from the following sources: (a) 1,000 and One, the Bluebook of Non-Theatrical Films, (b) Educational Film Catalog, (c) Motion Pictures of the World and Its Peoples, (d) Current Releases in Non-theatrical Films. Sixty-eight

of the one hundred film sources sent their catalogs and lists, and it was from these replies and the data that accompanied them that the selection of films was made.

This entailed a careful checking over of all the lists and catalogs received to ascertain from the titles of the films those that were related to the topic "weather". The mere fact that the lists were exhausted for titles should not indicate the finality of the selection. It was simply the first step. The results from the study made of the titles produced a most impressive list of 26 films. These were: Air Currents, American Red Cross to the Rescue, Atmosphere, Atmospheric Pressure, Back of Weather Forecast, Climate, Clouds, Dew Fall--Nature's Jewels, Fire Weather, Fury of the Storm, Hell Below Zero, Ice in Nature's Workshop, Mad Ohio, Man Against River, Mysteries of Snow, Niagara's Winter Wizardy, The Plow that Broke the Plains, Rain for the Earth, Reconquering Antarctica, Snowdrops in All His Glory, Story of a Disturbance, Story of Water, The Forest and Waters, Water Cycle, Water in Air, and Weather Forecasting. The next step was to take this list of 26 films and separate the silent films from the sound, in as much as only silent films were to be included in the final choice. There were 10 sound films in the group of 26. Thus the original list of 26 was narrowed to 16. These were subjected to the final selections. The basis for selection was taken from <u>The Motion Picture in Education</u> written by the American Council on Education and <u>Teaching with Motion Pictures</u> by Edgar Dale and Lloyd Ramseyer. These sources agreed that the following points should be considered in making a choice of films for classroom use: (1) their relation to the

objectives of instruction, (2) their pedagogical effectiveness for the attainment of these objectives, (3) their adaptability to age and grade levels, and (4) their technical qualities. In other words does the film in question harmonize with the objectives of weather and of General Science? Is the portrayal of material accurate? Could other teaching materials or activities such as slides, school journeys, demonstrations be used as effectively and with greater economy? Is the film material easily understood by pupils at the lowest grade level where the film will be used? It is evident, then, that in making a selection it is necessary to obtain more than a list of titles or even a meager catalog description if the films are to be considered real teaching aids.

There are three ways of determining this information which is to be used as a basis of selection: namely, the preview, the teacher's guide, and the catalog description. It is quite apparent that these three ways of determining the film content are not of equal value. The pre-view examination, wherein each film in question is shown first to the persons interested, is by far the most satisfactory. This method of selection allows the teacher who plans to use the film an opportunity to run it through in private, away from his class, and affords him an opportunity to find any technical defects, errors in subject matter, physical defects, in short, any objectionable features that might not otherwise be discovered if either of the other ways of selecting was used. Ideal as this method of pre-view seems to be, it has one very serious drawback: producers or distributors will not send films out on trial for such pre-views, unless of course the film is a

free one. This being true, that films will not be sent out on trial, only those schools located near enough to distributing points for the teacher to get in and preview the film there, are fortunate enough to be able to make use of this very excellent method. It would seem then that schools in or around large urban communities where distributors and producers are situated, are the only ones who may, by taking advantage of their locations, use the pre-view method. Towns and cities that are farther away must depend upon the teacher's guide and the catalog description. Even in the case of the pre-view, however, there is always the possibility that the producer or distributor in the nearby city will not have the film or films in question and thus that method of determining film content by the pre-view examination could not be used.

The Eastman Kodak Company, a very large producer of educational films, furnishes with each film a pamphlet called the Teacher's Guide. It is the purpose of the guide to acquaint the person or persons using the film with the subject matter or film content. This information includes a list of scene titles and graphic descriptions of the scenes. In addition, the guide offers supplementary notes and readings, pertinent questions, and problems that are related to the film content in general. With such information it is possible to judge the film with a better than average degree of success. These guides are furnished by all the distributors of the Eastman films.

The third and least reliable of the methods of selection is the catalog description. Each film catalog incorporates in its listings a description of the film. Some of the descriptions, though general,

are suggestive enough to allow a general concept of the film. On the other hand, some are so meager that it is almost impossible to form adequate conclusions concerning the subject matter. It is of course possible to get the required information by writing directly to the producer of the film in question, but teaching today makes such demands upon the teaching force that a very small minority would be willing to take the time and the trouble to do this.

The 16 films remaining after the 10 sound films had been eliminated were next subjected to the catalog description test to determine in a broad way whether or not any could be used in the teaching of the unit "weather". The results of this check-up are indeed interesting, especially to the teacher in service who perhaps anticipates teaching a block of work with films. On the surface it would seem that 16 films whose titles are based on weather and its various phases would furnish an abundance of moving action to cover the topic satisfactorily. However, such was not the case, for of the 16 films only four were finally selected for use. The reasons why the other 12 failed to measure up to the standards previously stated were: (1) material failed to meet the objectives of the unit, (2) film not available for dates required (this in spite of an estimated leeway of six weeks), (3) film withdrawn by producers, (4) material limited to one phase of subject matter only, (5) film not for rent, could be had only by purchasing.

The final check revealed four films that were available and might be satisfactory. Three of the four were produced by the Eastman Kodak Company whose distributing agent was located at the State House in Boston. The fourth film was produced by Fox Pictures and distributed

by Visual Education Service located at 131 Clarendon Street, Boston. These films were: Atmospheric Pressure, The Water Cycle, Weather Forecasting, all by Eastman, and Climate by Fox Pictures.

Each of the four films was carefully previewed at the distributing office, a privilege eagerly granted by both the distributors. The Teacher's Guides furnished by the Eastman Company for its three films were most helpful in this particular case, not for judging and selecting the films because the pre-view was entirely sufficient for that, but for the preparation that was necessary before the films could be shown to the classes so that maximum efficiency in their presentations could be assured.

The Physical Properties Concerning the Experiment

"The present program of science teaching in elementary and secondary schools is conducted in a specialized group of rooms equipped with a specialized set of materials."[66:281] Effective teaching and learning depend upon those physical qualities in the science curricula more than on any other. In the case of the science teacher a large amount of time and energy is devoted to procuring, devising, organizing, caring for, and manipulating materials. The pupil, for his part, approaches the work in science with a mental set in which the terms, experiment, laboratory, and apparatus are important elements. "It has been the usual practice, however, to adapt the usual classroom for work of this type."[66:283] This practice has not helped to attain the objectives set up by the educational authorities unless the science teacher with the help of someone who happens to be interested, takes it upon himself

to "adapt" the classroom for science teaching by making the necessary additions and changes that would transform the ordinary classroom into a science classroom.

It was not necessary that any changes be made in the classrooms where the experiment was carried out. The building, a large junior high school with an enrollment of about 1100 pupils, when it was constructed contained no provisions for the teaching of science. However, since its construction one room in each of the three grades has been transformed gradually until now there are three fairly acceptable science classrooms. The experiment was conducted in two rooms, one a science room and the other a projection room. Both of the rooms were originally classrooms.

The projection room, or dark room, still retains the characteristics of an ordinary classroom, although it has been transformed into a dark room by painting all the windows with heavy black paint, thus making it a very satisfactory projection center. The projector used in showing the films was a 16 m m, silent type Victor machine. A homemade curtain of white canvas approximately seven feet by nine feet was hung on the front wall. The projector was in the rear of the room. This arrangement of equipment permitted the pupils to use the room as they would an ordinary classroom. They sat in regular seats at desks as they viewed the films.

The science classroom, the other room used in the experiment, is in the same wing of the building as the projection room. It has a seating capacity for 40 pupils and has the regulation stationary desks and chairs. There is in the front of the room a large laboratory table

equipped with gas outlets and both hot and cold running water. Two electrical outlets are located at the base of the table on the floor. The closets, two of them, have been made over into storage space for chemicals and apparatus. The blackboards are of slate and are in the front and rear of the room. The one in the rear is used exclusively as a bulletin board, and part of the front board is devoted to the same purpose.

The apparatus and equipment used in the science room by the classes not viewing the films were for the most part adequate. The science room is equipped with the following instruments that are used when the unit "weather" is taught: mercury barometer, aneroid barometer, thermometers, both Centigrade and Fahrenheit, wet and dry bulb thermometer, large and mmall weather maps, cloud making apparatus, radiometer, and a revolving globe of the world. The physical apparatus did not include such materials as the barograph, thermograph, quadruple register, rain gauge, weather signals or sunshine recorder. However, in all fairness, it must be admitted that the apparatus not available for this experiment is not generally found in junior high school science classrooms, but as a rule is used only in weather stations or observatories. The tremendous cost of the apparatus would of itself make them prohibitive to classrooms, and in addition they are for the most part complicated instruments used only by experts in specialized fields.

Tests

Since the prime objective of testing is not to discover what a

child knows, but to learn whether the objective of a unit was reached and to ascertain the possible need of further study along a particular line of work, the tests that accompanied the experiment were planned with those purposes in mind. The large unit "weather" was subdivided into four smaller sections, each one a complete unit in itself. "At the end of a unit it is desirable--it is often administratively imperative--to 'take stock'; that is, to determine the degree to which pupils have attained the objectives sought in the unit or course."[66:218] This very thing was done as each sub-unit was completed; that is, after each film had been viewed, a test was given. The tests were similar in construction, type, and number of questions.

The four subdivisions of weather: atmospheric pressure, water cycle, climate, and weather forecasting were of equal importance, and so the idea of equality was extended to the formulating of the tests, and all were made to conform to a uniform standard as far as that was possible. Each test was mimeographed. All questions in the tests were of the multiple-choice type. Each test had 25 questions. The uniformity of the tests helped to make it easier for the child taking the tests since there was no deviation from type; once the child had become familiar with the physical aspect of the test there was no need for readjustment when the second, third, and fourth tests were presented. Once the mental set had been established there was no cause for it to be broken down since the succeeding tests differed from the first only in the material tested, not in the type or the number of questions. Care was taken that the intended meaning was conveyed correctly to the pupil, and that no question was ambiguous. The

questions were worded in such a way that the person who scored the tests would not be called to pass judgment as to how nearly right an answer to a question was, but merely determine that it was either right or wrong.[22:144-145 27:157/]

The tests were devised, after thorough, careful, and frequent revisions, so that they set up proper standards of achievement. The knowledge and skills that were tested included: (1) the understanding of the big ideas or generalizations, (2) the understanding of relationships of the facts and of the larger ideas, (3) the ability to develop and organize the larger ideas from given or know facts, (4) the skill to obtain essential knowledge from the experiment, the reading material--in those groups that used textbooks and not films for the acquisition of their information--and other sources, (5) the ability to use generalizations in interpreting new situations, (6) the ability to interpret relationships of cause and effect, (7) the ability to classify, (8) the ability to control simple experimental procedures, and (9) skill in solving problematic situations by scientific thinking.[66:218] Each test was formulated so that it would succeed in measuring the thing for which it was devised.

In addition to the mimeographed tests there are other ways of determining the success of an experiment and learning whether or not the objectives were reached. The actual behaviors performed by pupils in life situations as a result of their work in science is a more significant measure of the success of the course or unit than is the acquisition of knowledge and skills.[25:65/] One excellent measure of the outcomes is the number and quality of voluntary activities,

beyond the requirements of the course, which pupils complete--the home activities they carry on, the science reading they do, the helpfulness they exhibit in the classroom, and the bulletin board material they supply. All those activities will aid the teacher in deciding for himself whether or not the goal which he has set as the learning objective has been reached. Yet those proofs are wholly objective and must be put aside when statistics are to be quoted. Thus, in drawing conclusions when the experiment was completed, it was not the human adjustments that were considered--merely the results as shown by the purely objective tests.

Test 1. Atmospheric Pressure

In each of the following sentences you are to find the right answer. Draw a line under it and then put the number that is in front of it in the space that has been provided for it at the right.

1. The land compared with water heats 1. more slowly 2. more quickly 3. just the same.

2. Warm air compared with cold air is 1. lighter 2. heavier 3. the same in weight.

3. Dust and papers always follow a fast moving train because of 1. suction 2. air rushing in 3. gravitational pull.

4. The liquid used in the barometer is 1. alcohol 2. mercury 3. ether.

5. A pump must sometimes be primed because 1. the spout is broken 2. a poor cardiac value 3. air leaks by piston.

6. At the beach during the summer the breeze during the day is 1. from the water 2. from the land 3. along the beach.

7. The pressure of air per square inch at sea level is about 1. $1\frac{1}{4}$ ounces 2. 15 pounds 3. 62.5 pounds.

8. A recording air pressure instrument is called 1. a seismograph 2. a barograph 3. a pantograph.

Test 1. (continued)

9. The word best describing the comparison of the weight of smoke with that of air is 1. lighter 2. the same 3. heavier.

10. At the seashore in the evening the breeze blows toward 1. the land 2. the water 3. along shore.

11. Our bodies are not crushed by air pressure because 1. we are used to it 2. we have air inside 3. we wear clothes.

12. The barometer reading in a valley compared to a mountain reading is 1. higher 2. lower 3. the same.

13. The rise of water in pumps is caused by 1. suction 2. pressure 3. gravity.

14. Drafts are always noted near large bonfires because 1. fires need much air 2. warm air is expanding 3. carbon dioxide is being formed.

15. Nose bleeds are frequent at high altitudes because of 1. extreme temperatures 2. high winds 3. decreased pressure.

16. Water can be lifted with a lift pump about 1. 30 feet 2. any height 3. 10 feet.

17. Air exerts pressure 1. in all directions 2. only on the earth 3. at sea level.

18. In winter, summer resorts near the water compared with inland cities are 1. colder 2. warmer 3. the same.

19. Increased air pressure 1. raises the boiling point 2. lowers it 3. does not change it.

20. The pressure in a dust bag of a vacuum cleaner compared with ordinary pressure is 1. greater 2. less 3. the same.

21. The pressure of air is measured in one of the following units 1. pounds 2. inches 3. cubic feet.

22. Dirt and dust rush into a vacuum cleaner because 1. of suction 2. air rushing in 3. fan drags them in.

23. Potatoes cannot be cooked on Pike's Peak because 1. water won't boil 2. pressure is low 3. fires won't burn.

24. A rise of approximately 1000 feet would mean a change in air pressure records of 1. one inch 2. 15 lbs. 3. 30 feet.

Test 1. (concluded)

25. The maximum pressure in an electric fan is 1. before the blades 2. in back of the blades 3. around the sides of the blades.

Test 2. The Water Cycle

In each of the following sentences you are to find the right answer. Draw a line under it and then put the number that is in front of it in the space that has been provided for it at the right.

1. The high, light, fleecy clouds are called 1. cirrus 2. nimbus 3. cumulus

2. Property loss caused by flood has been estimated at 1. one thousand dollars 2. one million dollars 3. one billion dollars.

3. Moraine is the term applied to earth, stones, and other debris carried along by 1. a glacier 2. a river 3. tidal wave.

4. The cycle of water from earth to air and back to earth again goes on 1. during the day 2. during the night 3. during night and day.

5. The term stalactite refers to formations found 1. in river beds 2. underground caves 3. mountain tops.

6. Underground caves are found in regions where the rock under the soil is 1. limestone 2. sandstone 3. pudding stone.

7. When moisture is condensed high above the earth and then falls through layers of air below the freezing point it falls as 1. hail 2. snow 3. sleet.

8. The level of the water beneath the surface is called 1. underground water 2. sunken reservoir 3. water table.

9. In fine weather the most frequent form of cloud is 1. nimbus 2. cumulus 3. cirrus.

10. Clouds are formed from 1. condensed vapor 2. dust particles 3. heavy smoke.

11. Nimbus clouds may be described as 1. dark with condensing vapor 2. light fluffy masses 3. "cotton bale" clouds.

12. When a cloud is about to dissolve into rain it 1. acquires a greater density 2. rises high above the earth 3. draws water from the air.

Test 2. (concluded)

13. On rainless plateaus wells are impractical because 1. there is no rain 2. the water table is too deep 3. the soil is too rocky.

14. In regions of heavy snow fall people get around by using 1. skis 2. snow shoes 3. dog sleds.

15. The greater part of our rainfall is 1. evaporated 2. surface water 3. underground water.

16. Springs are fed by 1. underground water 2. surface water 3. river water.

17. Water always rises in a well 1. as high as the water table 2. to the top of the well 3. not more than 30 feet.

18. The spread of the tree's root system below the earth tends to 1. equal that of its branches above 2. be less than the spread of branches above 3. be more than the branches above.

19. The "oceans of the continent" is a name given to 1. moisture given off by trees. 2. the Atlantic and Pacific 3. all the various types of clouds.

20. Clouds are constantly moving because 1. condensation is taking place 2. warm air is rising 3. air currents are present.

21. The first step in the water cycle is 1. condensation 2. evaporation 3. precipitation.

22. Fishermen believe that "a mackerel sky" is a sure sign of 1. rain 2. clear weather 3. good fishing.

23. The pond or lake in any region always marks the level of 1. the last rainstorm 2. water table 3. high tide mark.

24. The source of water in wells is 1. rain 2. water table 3. tides.

25. Fogs on our earth are forms of 1. smoke 2. clouds 3. dew.

Test 3. Weather Forecasting

In each of the following sentences you are to find the right answer. Draw a line under it and then put the number that is in front of it in the space that has been provided for it at the right.

Test 3. (continued)

1. Close accurate reading of a mercurial barometer is obtained by using 1. vernier 2. caliper 3. meter.

2. The maximum thermometer is reset by 1. whirling it rapidly 2. letting it alone 3. wrapping bulb with damp cloth.

3. The velocity of wind is measured by 1. manometer 2. psychrometer 3. anemometer.

4. Weather conditions are sent to the central office for tabulation by 1. radio 2. telephone 3. telegraph.

5. The wet and dry bulb thermometer used for weather observations is called 1. whirling thermometer 2. whirling psychrometer 3. whirling hydrometer.

5. "High" and "Low" on a weather map refer to 1. air pressure areas 2. temperature areas 3. topography areas.

7. The general direction of storm paths in the U. S. is 1. east to northeast 2. west to southwest 3. south to southeast.

8. In our northern hemisphere great volumes of air revolving counter clockwise are called 1. cyclones 2. hurricanes 3. tornadoes.

9. A weather map is a view of 1. the U. S. in outline 2. storms and storm damages 3. specimen of weather instruments.

10. Iso-bars are lines that connect places of equal temperature 2. equal rainfall 3. equal pressure.

11. The wet and dry thermometer is used to obtain 1. humidity of air 2. temperature of air

12. Air pressure in the winter as compared with summer pressures is 1. greater 2. less 3. the same.

13. In a "low" the wind direction is 1. away from center 2. toward the center 3. in an up and down motion.

14. Places having the same temperatures at the same time are connected by lines called 1. isotherms 2. isobars 3. isopods.

15. Our stormy weather always occurs during periods of 1. "highs" 2. "lows" 3. "belows".

16. The sunshine recorder used by weather stations is 1. a large

Test 3. (concluded)

revolving mirror 2. narrow glass tube with bulb-like ends, one containing mercury 3. a barrel form graph connected to an electric pen.

17. In a wet and dry thermometer the wet bulb generally registers 1. lower temperature 2. the same as the dry 3. higher temperature.

18. In general, warmer cloudy weather is characteristic of 1. anti-cyclones 2. cyclones 3. hurricanes.

19. If you were allowed but one instrument to aid in weather forecasting it would be 1. a thermometer 2. a barometer 3. a sunshine recorder.

20. The wick on the wet bulb thermometer is soaked in 1. water 2. mercury 3. alcohol.

21. The mechanism of a rain gauge may be described as 1. a revolving drum-like instrument 2. an instrument much like a thermometer 3. a bucket-like affair with a funnel top.

22. The number of stations taking observations for weather forecasting in the U. S. is about 1. 235 2. 535 3. 1235.

23. Most of the large weather disturbances beginning in Oregon will travel toward 1. the St. Lawrence River or the Atlantic 2. Southern California and its gulf 3. the Gulf of Mexico.

24. The relative humidity is most important in weather forecasting it refers to 1. the heat of the day 2. the clouds in the sky 3. the ratio of the amount of moisture in the air.

25. The U. S. Weather Bureau is sponsored and maintained by 1. the departmeht of Agriculture 2. influential business men 3. the U. S. Merchant Marine.

Test 4. Climate

1. The temperature on a mountain top as compared with the valley below is 1. higher 2. lower 3. same.

2. Rain seldom falls on the eastern slopes of the Rocky Mts. because 1. part of this territory is desert 2. the ocean is too far away 3. ascending air cools and loses its moisture.

3. The term used to describe the features of a region is 1. topography

Test 4. (continued)

2. geography 3. physiology.

4. Weather may be accurately defined as 1. the condition of the air 2. a succession of stormy days 3. blue skies and sunshine.

5. As a general rule the most energetic people are those who live in 1. far north 2. Tropics 3. Temperate regions.

6. If you lived in the frigid zone in winter you would probably be dressed in 1. furs 2. cloth coats 3. light cotton goods.

7. The average temperature during winter in the torrid zone is 1. 0° F 2. 32° F 3. 75° F.

8. The boundary lines of the zones of the earth are 1. lines of longitude 2. lines of latitude 3. no lines at all.

9. The northern boundary of the torrid zone is 1. Tropic of Cancer 2. Tropic of Capricorn 3. Equator

10. On June 21 in Belmont the people are planting and harvesting certain vegetables; in Argentina on the same date the people are 1. doing the same thing 2. getting ready for winter 3. Notice no change at all.

11. The tradé winds of the earth originate 1. at the Equator 2. over Antarctica 3. in the Temperate Regions of the earth.

12. The only people who actually see the sun directly over their heads at noon are 1. people in Columbia 2. people in California 3. people in Norway.

13. Climate may be defined as 1. a generalized statement of the weather 2. peoples, animals and plant life of a region 3. dry, damp, wet places on the earth.

14. A gradual change in climate 1. will change animal life gradually 2. will change animal life quickly 3. will have no effect at all.

15. The greatest variety of foods is found in 1. temperate 2. frigid 3. torrid zones.

16. Cattle and beef can be supported best in the 1. temperate 2. frigid 3. torrid zones.

17. The greatest variety of occupations is found in 1. frigid 2. temperate 3. torrid zones.

Test 4. (concluded)

18. It is warmer in summer than in winter in Belmont because 1. the sun is nearer the earth 2. June 21 is the 1st day of summer 3. the angle of sun's rays is more direct.

19. To know the climate of any given place one would have to visit for 1. a day 2. a month 3. a year.

20. One of the following makes the climate of England more temperate 1. trade winds 2. Doldrums 3. Gulf Stream.

21. In traveling the climate would change as you crossed 1. lines of latitude 2. lines of longitude 3. Equator.

22. The region of the world called the "horse latitudes" is a region of 1. fine horses 2. brisk winds 3. dead calm.

23. The seasons of the year are determined by 1. scientists 2. U. S. Weather Bureau 3. Revolution and Earth's tilting.

24. Land near large bodies of water has 1. constant temperature 2. slightly varying temperature 3. wide ranges of temperature.

25. The reason we do not tan in the winter time is because 1. temperature is low 2. we wear more clothes 3. oblique angle of sun's rays.

Results of the Experiment

The status of the educational motion picture has once again been established, for this time also statistics show that teaching with films yields far greater results than ordinary teaching without them. Although it was not the primary purpose of this experiment to prove this superiority, the results are indeed gratifying and show that the groups that were shown the films achieved higher scores on the final tests than were obtained by the groups that did not see the films. A comparison of the two groups, film and non-film, based on the medians achieved for each of the four tests show the following results. The pre-test results for the first section of work, "Atmospheric Pressure",

for the film group which was composed of 164 pupils and for the non-film group composed of 153 pupils were in terms of median scores: a score of 56 for the film group and a similar score of 56 for the non-film group. Thus the median scores for the pre-test were identical for both the experimental and the control groups, but the achievement after teaching had taken place was a gain in the median score of the film group above that gained by the non-film group. The final test resulted in a median score of 80 for the film group as contrasted with the median score of 72 for the non-film group, thus showing an improvement of 24 points for the film group and 16 points for the non-film group. In terms of percent this showed that the film group surpassed the non-film group in the information that they learned, thus establishing a superiority of 14.28 per cent.

The results of the second section on the "Water Cycle" show an even greater difference. The pre-test results again were in terms of medians: 48 for the film group and 52 for the non-film group, an advantage of four points for the non-film group before teaching had begun. In the final test, the film group of 168 pupils scored a median of 80 while the non-film group of 158 pupils scored a median of 64. The difference in median scores between the two groups in this final test was 16. On the percentage of superiority based on the difference between pre-test scores and final test scores for the two groups was the rather amazing figure of 43.59 per cent in favor of the film group.

The third section, "Climate", showed the following results: the pre-test scores for the film group of 160 pupils and the non-film group of 170 pupils showed that the medians were again identical--56.

After teaching, the film group had a median of 76 in the final test, and the non-film group a median of 72. The differences between the median scores for the pre-tests and the final tests for each group were 20 for the film group and 16 for the non-film group--a superiority of 7.14 per cent.

The final block of subject matter entitled "Weather Forecasting" showed the following results. The pre-test results in terms of median scores were 52 for the film group of 153 pupils and 48 for the non-film group of 166 pupils. In the final test the film group had a median of 80, an improvement of 28 points and the non-film group had a median of 72, improvement of 24 points. In percentage this shows that the film group advanced 3.84 per cent further than the non-film group in the amount of learning acquired.

A summary of the per cents for all four sections shows that the film group made an average advance of 49.76 per cent while the advance made by the non-film group was 32.55 per cent. A comparison of the two figures shows that the groups that were shown the films made an average improvement of 17.21 per cent over the advance made by the non-film groups.

The pre-test and final test scores in both the film and non-film classes for each of the four topics studied were charted so that results might be interpreted and percentage comparisons attained. The charts appear with this topic.

It was not possible to administer tests for recall and retention because of a time limit. However, three outstanding studies made by

Rulon, Knowlton and Tilton, and Arnspiger show that teaching with films is definitely superior to the regular classroom procedure. Rulon says, "....not only did the film children learn more and remember more, but they remembered a larger percentage of the larger amount they had learned."[62:88] Rulon's percentage shows a 38 per cent superiority over the ordinary classroom method. Knowlton and Tilton found in their experiment that "the children learned more, forgot more, and remembered more" than the pupils who were not taught with films. Arnspiger shows graphically the superiority of the film group over that of the control or non-film group, and the per cents of superiority ranged from nine to 18.[2:86] These results therefore justify the conclusion that the use of films in classroom teaching aids materially in the final results obtained, and there is no reason to believe that the results of this experiment as it was performed would differ from the results as stated by the three authorities quoted.

Significance of the percentage differences.-- The statistical significance of the percentages derived from the tables is obtained by computing the probable error of percentage frequency and the significance of percentage differences.

The equation used for finding the probable error is

$$P.E.\ fp = .6745 \sqrt{\frac{fp\ (100-fp)}{N}}$$

in which fp is the percentage score or frequency, and N is the number of cases.

Applying this formula to Table II A--Atmospheric Pressure--with

its fp of 42.84 which was obtained by comparing the medians of the pre-test and final test scores we have:

$$\text{P.E. of } 42.84\% = .6745\sqrt{42.84\ \frac{(100-42.84)}{164}} = 2.60$$

This being more than five times the P.E. is significant.

Applying this same formula to Table II B--Atmospheric Pressure--with its fp of 28.56 which was obtained by comparing the medians of the pre-test and final test scores we have:

$$\text{P.E. of } 28.56\% = .6745\sqrt{28.56\ \frac{(100-28.56)}{153}} = 2.48$$

This being more than five times the P.E. is significant.

If 42.84 per cent was the percentage of gain for the film group as shown on Table II A and 28.56 per cent represents the gain for the non-film group as shown an Table II B, the difference is 14.28 per cent in favor of the film group. How significant is this percentage difference of 14.28 per cent.

The formula for the significance of percentage difference is

$$\text{P.E. (diff.)} = \sqrt{(\text{P.E. of 1st per cent})^2 + (\text{P.E. of 2nd per cent})^2}$$

or

$$\text{P.E. (diff.)} = \sqrt{2.60^2 + 2.48^2} = 3.59$$

Therefore the difference 42.84--28.56 may be written 14.28 + 3.59. This difference being less than five times (3.59 x 5 = 17.95) the P.E. is not a significant difference.

Using these same formulas for Tables III A and III B we have for

Table IIIA P.E. of 66.66% = $.6745\sqrt{\frac{66.66\ (100-66.66)}{168}} = 2.44$

Table IIIB P.E. of 23.07% = $.6745\sqrt{\frac{23.07\ (100-23.07)}{158}} = 2.26$

P.E. (diff.) = $\sqrt{2.44^2 + 2.26^2} = 3.32$

Therefore the difference 66.66--23.07 may be written 43.59 + 3.32. This difference being more than five times the P.E. (3.32 x 5 = 16.60) is a significant difference.

For Tables IVA and IVB the formulas show:

Table IVA P.E. of 35.70% = $.6745\sqrt{\frac{35.70\ (100-35.70)}{160}} = 2.54$

Table IVB P.E. of 28.56% = $.6745\sqrt{\frac{28.56\ (100-28.56)}{170}} = 2.33$

P.E. (diff.) = $\sqrt{2.54^2 + 2.33^2} = 3.44$

Therefore the difference 35.70--28.56 may be written 7.14 $\pm$ 3.44. This difference being less than five times the P.E. (3.44 x 5 = 17.26) is not a significant difference.

For Tables VA and VB the formulas show:

Table VA P.E. of 53.84% = $.6745\sqrt{\frac{53.84\ (100-53.84)}{153}} = 2.72$

Table VB P.E. of 50.00% = $.6745\sqrt{\frac{50.00\ (100-50.00)}{166}} = 2.62$

P.E. (diff.) = $\sqrt{2.72^2 + 2.62^2} = 3.77$

Therefore the difference 53.84--50.00 may be written 3.84 $\pm$ 3.77. This difference being less than five times the P.E. (3.77 x 5 = 18.85) is not a significant difference.

Significance of the final percentage differences.-- An average of the percentage scores of the four "A" tables was 49.76 per cent. An average of the percentage scores of the four "B" tables was 32.55 per cent. Applying the formula for finding the probable error, we have:

$$\text{"A" tables P.E. of } 49.76\% = .6745\sqrt{\frac{49.76\ (100-49.76)}{161}} = 2.65$$

$$\text{"B" tables P.E. of } 32.55\% = .6745\sqrt{\frac{32.55\ (100-32.55)}{162}} = 2.48$$

$$\text{P.E. (diff.)} = \sqrt{2.65^2 + 2.48^2} = 3.63$$

Therefore the difference 49.76--32.55 may be written 17.21 $\pm$ 3.63. While the difference is not five times its P.E. (3.63 x 5 = 18.15), yet it approaches it and therefore is in the border-zone of a significant difference.

Table IIA. Showing the scores made by pupils in five different classes who saw the film after the Pre-test and before the Test. In other words, the scores for the Film Group.

Film Group					Atmospheric Pressure						Mr. X.	
	Class A		Class B		Class C		Class D		Class E		Totals	
% Score	Pre-Test	Test	Pre-Test	Test	Pre-Test	Test	Pre-Test	Test	Pre-Test	Test	Pre-Test	Test
100											0	0
96						6		1		1	0	8
92					1	8		1		3	1	12
88		1		6		6		3	1	7	1	23
84		1		5	2	7		6		7	2	26
80		2		2		5		6	2	4	2	19
76	3	6	2	7	1	3		2	2	5	8	23
72	2	5		6	4			6	1	3	7	20
68	1	8	4	3	2		2	2	1		10	13
64	3	4	5	1	8		5	2	4		25	7
60	4	4	7	1	7		4		2		24	5
56	2	3	3	1	3		1		5	1	14	5
52	8	1			3		6		5		22	1
48	3	1	7		2		3		6		21	1
44	2		1		1		2		1	1	7	1
40	4				1				1		6	0
36	2		1				2		1		6	0
32	1						3				6	0
28			2				1				1	0
24												
20												
16	1										1	0
Totals	36	36	32	32	35	35	29	29	32	32	164	164
Median	52	68	60	76	64	88	52	80	56	84	56	80
Diff.		+16		+16		+24		+28		+28		+28

Mean 23.3

Table IIB. Showing the scores made by pupils in five different classes who used the textbook after pre-test and before test. In other words, scores for the non-film group.

Non Film					Atmospheric Pressure						Mr. Y.	
	Class A		Class B		Class C		Class D		Class E		Totals	
% Score	Pre-Test	Test	Pre-Test	Test	Pre-Test	Test	Pre-Test	Test	Pre-Test	Test	Pre-Test	Test
100												
96		1										1
92		1		2				1				4
88	1	3		1		2		1		1	1	8
84		4		3	1	1		1			1	9
80	4	5	1	4		2		2	1	2	6	15
76	1	8	2	1	2	3	4	3	3	3	12	18
72	3	6	1	6	2	2	3	4	2	5	11	23
68	5	2	2	5	4	6	3	3		3	14	19
64	4	1	1	3	4	4	1	8	1	4	11	20
60	3	3	3	4	2	3	5	2	5	1	18	13
56	2		2	3	4	2	5	1	3	5	16	11
52	3		5		1	1	2	3	5	1	16	5
48	3	1	5		1	1	2			2	11	4
44	2		3		1		1	1	4		11	1
40	1		3		2			1	1	1	7	2
36			2				2		1		5	
32	2		1		1		1				5	
28	1		1						2		4	
24					1		2				3	
20					1						1	
16												
Totals	35	35	32	32	27	27	31	31	28	28	153	153
Median	64	76	52	72	60	68	60	64	56	64	56	72
Diff.		+12		+20		+8		+4		+8		+16

Mean 11.3

Table IIIA. Showing the scores made by pupils in five different classes who saw the film after the pre-test and before the test. In other words, the scores for the Film Group.

Film						Water Cycle					Mr. X	
% Score	Class A Pre-Test	Test	Class B Pre-Test	Test	Class C Pre-Test	Test	Class D Pre-Test	Test	Class E Pre-Test	Test	Totals Pre-Test	Test
100						1					0	1
96						1		1			0	2
92				3		6		1		3	0	13
88		1		5		9		5		5	0	25
84		4		7	1	10		7		7	1	35
80		2		3	1	4		4		5	1	18
76		3		6	2	3		3	1	3	3	18
72		10	1	3	3	1	1	1	3	2	8	17
68	1	4	2	2	5		1	3	2	1	11	10
64	2	6	3	1	2		2		4	2	13	9
60		4	3	2	5			1	3	2	11	9
56	2	1	5		3	2	5	1	3		18	4
52	7		2	1	3		2	2	3		17	3
48	4		2		4		3		9	2	22	2
44	10		6		3	1	4				23	1
40	6		3		2		2		2		15	0
36	2		3		3		2		2	1	12	1
32	1		1		1		2				5	0
28			1				3		1		5	0
24			1				2				3	0
20											0	0
16											0	0
Totals	35	35	33	33	38	38	29	29	33	33	168	168
Median	44	72	48	80	56	84	44	80	52	80	48	80
Diff.		+28		+32		+28		+36		+28		+32

Mean 29.0

Table IIIB. Showing the scores made by pupils in five different classes who used the textbook after pre-test and before test. In other words, scores for the Non-film Group.

Non-Film					Water Cycle						Mr. Y	
	Class A		Class B		Class C		Class D		Class E		Totals	
% Score	Pre-Test	Test	Pre-Test	Test	Pre-Test	Test	Pre-Test	Test	Pre-Test	Test	Pre-Test	Test
100												
96												
92												
88				1								1
84		1						1				2
80	1	2		1			1	3		1	2	7
76	2	3	2	3		2	2	1	1	1	7	10
72	3	5	1	5	2	3	2	4		2	8	19
68	2	2	4	4	1	5	1	6	3	3	11	20
64	2	6	2	6	4	4	1	5	1	4	10	25
60	3	5	3	8	2	3	9	5	3	5	20	26
56	4	3	5	3	3	2	4	1	4	2	20	11
52	5	2	6		3		3	3	6	3	23	8
48	4	1	3	2	2	4	1		2	0	12	7
44	3	1	3	3	2	2	1	1	1	5	10	12
40	1	2	2		3		1		3	2	10	4
36	2	1	3	2	1	1	3		2	1	11	5
32	1		2		1		1		1		6	
28	1		1			1					2	1
24					2				1		3	
20			1						1		2	
16					1						1	
Totals	34	34	38	38	27	27	30	30	29	29	158	158
Median	52	64	52	64	52	64	60	64	52	60	52	64
Diff.		+12		+12		+12		+4		+8		+12

Mean +10.0

Table IVA. Showing the scores made by pupils in five different classes who saw the film after the pre-test and before the test. In other words, the scores for the Film Group.

Film Group					Climate						Mr. Y.	
	Class A		Class B		Class C		Class D		Class E		Totals	
% Score	Pre-Test	Test	Pre-Test	Test	Pre-Test	Test	Pre-Test	Test	Pre-Test	Test	Pre-Test	Test
100												
96		1		1							0	2
92		3		1						1	0	5
88		6		4		2		2		3	0	17
84		7		3		1		4		5	0	20
80	1	6		6		2	1	5		3	2	22
76	2	7	1	4		7	1	8		7	4	33
72	3	6	3	8		6	2	7	1	9	9	36
68	3		3	6	2	4	3	2	2	3	13	15
64	4		5	2	1		1	1	5	1	16	4
60	6		6	1	2	1	3		6	1	23	3
56	4		7	1	3	1	4		3		21	2
52	4		2		2		4		2	1	14	1
48	4		1		1		2		3		11	0
44	2		3		5		2		4		16	0
40	1		4		4		2		1		12	0
36	1		1		2		1		4		9	0
32					1		1		1		3	0
28			1		1		1		2		5	0
24	1										1	0
20							1				1	0
16												
Totals	36	36	37	37	24	24	29	29	34	34	160	160
Median	60	80	56	76	44	72	56	76	52	76	56	76
Diff.		+20		+20		+28		+20		+24		+20

Mean +22

Table IVB. Showing the scores made by pupils in five different classes who used the textbook after pre-test and before test. In other words, scores for the Non-film Group.

Non-Film					Climate						Mr. X.	
	Class A		Class B		Class C		Class D		Class E		Totals	
% Score	Pre-Test	Test	Pre-Test	Test	Pre-Test	Test	Pre-Test	Test	Pre-Test	Test	Pre-Test	Test
100												
96						1				1		2
92				1		2		1	1	1	1	5
88		1		2	2	5		1		3	2	12
84		3		2		7				2		14
80		2		3	3	7	1		1	6	5	18
76	2	6		5	4	5		2	4	4	10	22
72		4	3	4	4	4		8	1	8	8	28
68	1	8	1	5	3	3	4	4	2	3	11	23
64	4	4	3	2	5		2	3	6	1	20	10
60	7	3	10	4	3	1	4	1	3	1	27	10
56	3	2	6	4	2	2	5	2	3		19	10
52	6	3	7	2	4	1	4	1	4	2	25	9
48	5				5		2	1	1		13	1
44	4	1	3		3		1	1	2	1	13	3
40	2		1					1	1		4	1
36	1						2	1	1		4	1
32							2		2		4	
28	2						1	1			3	1
24												
20									1		1	
16												
Totals	37	37	34	34	38	38	28	28	33	33	170	170
Median	52	68	56	72	64	80	56	68	60	76	56	72
Diff.		+16		+16		+16		+12		+16		+16

Mean 15.3

Table V A. Showing the scores made by pupils in five different classes who saw the film after the pre-test and before the test. In other words, the scores for the film group.

Film Group					Weather Forecasting						Mr. Y.	
	Class A		Class B		Class C		Class D		Class E		Totals	
% Score	Pre-Test	Test	Pre-Test	Test	Pre-Test	Test	Pre-Test	Test	Pre-Test	Test	Pre-Test	Test
100											0	0
96		1		1				1			0	3
92		4				3		5		1	0	13
88		5		7		1		3		3	0	19
84		6		4		4		5		3	0	22
80		8		7		4		3	1	5	1	27
76		3		6		4		6		5	0	24
72	2	3		6	1	5	1	4		9	4	27
68	2	2	2	2		1	1	1	1	3	6	9
64	6	1	2	2	3		4	2	3		18	5
60	5	1	1	2	3	1	4		3		16	4
56	4		2		1		7		5		19	0
52	5		6		5		4		5		25	0
48	1		7		3		3		1		15	0
44	3		3		2		1		3		12	0
40	3		4		2		1		3		13	0
36	1		5		2		3		1		12	0
32	2		3		1		1		1		8	0
28			2						1		3	0
24											0	0
20									1		1	0
16												
Totals	34	34	37	37	23	23	30	30	29	29	153	153
Median	56	80	48	80	52	80	56	80	52	76	52	80
Diff.		+24		+32		+28		+24		+24		+28

Mean +26.6

Table V B. Showing the scores made by pupils in five different classes who used the textbook after pre-test and before test. In other words, scores for the non-film group.

Non Film					Weather Forecasting						Mr. X.	
	Class A		Class B		Class C		Class D		Class E		Totals	
% Score	Pre-Test	Test	Pre-Test	Test	Pre-Test	Test	Pre-Test	Test	Pre-Test	Test	Pre-Test	Test
100												
96						2						2
92				1		2				1		4
88				3		4				1		8
84				1		3		2		3		9
80		4		3		7		2		2		18
76		5	1	5		5		2		5	1	22
72		6		5	2	7				4	2	22
68	1	7	2	5	2	4		7	2	1	7	24
64	1	6	1	3	4	1		2		4	6	16
60	1	5	3	2	5	2	2	3	4	6	15	18
56	3	1	4	3	7		2	2	2	3	18	9
52	7	2	5	1	5		3	1	5	1	25	5
48	6		4		4		4	1	4	2	22	3
44	6	1	3		4		6	1	5		24	2
40	4		6		1		1	1	4		16	1
36	3		3		2		4	1	2		14	1
32	2				1		1	1	1		5	1
28	1						2	1	2		5	1
24	2										2	
20									1		1	
16							2		1		3	
Totals	37	37	32	32	37	37	27	27	33	33	166	166
Median	48	68	48	72	56	76	44	64	48	68	48	72
Diff.		+20		+24		+20		+20		+20		+24

Mean 21.3

Summary

Brief description.-- The entire ninth grade of a junior high school was used to conduct the experiment of teaching a specified unit of General Science by both the classroom method and the use of silent films. Four one-reel silent films which contained subject matter related to the unit weather were selected for use in the experiment. These films were entitled: Atmospheric Pressure, the Water Cycle, Climate, and Weather Forecasting. The classes of the entire grade were so arranged that they were taught one half of the unit by one method of instruction and the remaining half by the other method. Thus one teacher taught two of the topics by the use of films and the other two topics by regular classroom procedure. The other teacher carried out the same plan at the same time in reverse order.

The purpose of the study which has been described in the preceding pages was two-fold: (1) to act as a guide, and to furnish certain information, procedures, and techniques to the teachers of General Science; and (2) to determine the relative effectiveness of teaching a unit of General Science with silent motion pictures, contrasting this effectiveness with that of the ordinary classroom teaching of the same unit.

Plan

The two teachers who carried out the experiment taught General Science five periods a week to the entire grade. No homework was assigned at any time because a school regulation prohibits it. The teachers divided the subject matter in the following manner: Teacher X was to teach the topics Atmospheric Pressure and the Water Cycle

to his groups with two of the films listed but without the use of the textbooks. While this was going on, Teacher Y taught his groups the same subject matter using the text and any other teaching aids at his command with the exception of the motion picture. The time allotted to both X and Y for the teaching of this material was the same, and both pre-tests and final tests were identical. At the completion of this part of the experiment the teachers reversed the procedures and taught the remaining two topics of the unit. Teacher X now taught without films but with the ordinary classroom procedure, while Teacher Y taught with films and without textbooks. The experiment continued for ten full teaching days. Each group received a total of 250 minutes of instruction by film and a similar amount of classroom teaching.

Plans of the general subject matter as well as teachers' guides were provided for each teacher. These suggested procedures, activities, and placement of subject matter. The subject matter was divided into four main sections which corresponded with the titles of the four films and were called atmospheric pressure, the water cycle, climate, and weather forecasting.

Objective tests devised for the dual purposes of the pre-test and the final test were of the multiple choice type and were administered to all groups twice, once as the pre-test before teaching was begun, and again as a final test after teaching had been completed. There were four tests based on the subject matter of the entire unit but arranged to fit each main section or topic. The tests were strictly factual and measured only the amount of subject matter mastered. Because of the difficulty in attempting to measure objectively the attitudes,

skills, and appreciations, this type of test seemed preferable.

General results.-- The results of the experiment showed a superiority in favor of the film-group. A summary of the per cents which were obtained by averaging the differences between the pre-test results and the final test results for both the film and the non-film groups shows that in all the four different topics the film group made an average advance of 49.76 per cent while the advance made by the non-film group was 32.55 per cent. A comparison of the two figures shows that the groups that were shown the films made an average improvement of 17.21 per cent over the advance made by the non-film group. By applying the Holzinger Formulas for finding the percentage differences and the probable error, this improvement was significant.

Further problems.-- The present study indicates the effectiveness of the educational film as an aid to the teaching of a unit in General Science. This demonstration of effectiveness within these narrow ranges of instruction suggests many other possibilities for research.

Foremost among these possibilities is thatof the revision of the curriculum of modern education. In spite of the progress made in the mechanical fields to enable man to overcome the limitations of his environment, education has and still does to a large extent continue to depend largely upon the printed word for the transfer of ideas. Telescopes, microscopes, moving picture cameras, slow motion, time lapse devices, sound recorders, amplifiers and transmitters have made many significant and fundamental contributions upon which the reality of concepts depends. To those responsible for the construction of the

curriculum the educational film, with the inherent advantages of the telescope, the microscope, slow motion, time lapse photography, and animation may well issue the challenge for an extension of the curriculum.

Still another possibility for research lies in the field of testing. By means of the motion picture the pupil experiences life unfolding before him in real situations. He is made to live within the picture itself; seated in the audience his mind takes flight and becomes an active participant in the scenes enacted before his eyes. Attitudes and appreciations are developed between the pupil and his environment. How can such attitudes and appreciations be measured by objective tests? Yet it is only by means of objectively testing these attitudes and appreciations that the value of the film can be completely determined.

The possibility of using the film as a medium for large group instruction offers still another field of research. The cost of group instruction by films augurs well in the stress of modern times when economy must ever be considered. It would, however, involve a study of types and amounts of subject matter which could be presented to large groups at one time. Certainly it would relieve the teacher of much routine work and allow him to put his time into administering to the individual needs of his pupils.

The method of presenting films to a group to insure greatest efficiency is still another possibility for research. Should films be shown once, twice, or three times? Is there a method to determine the optimum procedures to be followed in administering the motion pic-

ture on the various levels of education? Much has been done, but as yet no definite proof has been established as to the set number of film showings which guarantee maximum efficiency.

~~Limitations of the study~~.-- The results of this experiment although favorable show that the experiment was by no means perfect. In a study of this kind limitations appear and must be recognized. The limitations of this study are:

1. The evident fact that the testing done is largely drill testing as always in tests such as used in the study.

2. The possibility that some or even much of the teaching was not superior type of teaching.

3. The further possibility that many significant possible values were not discovered in the testing and evaluating which was done.

4. It would be well to recognize that other changes in teaching plan might be even more significant than merely using the films, such as doing real problem work throughout based upon problems coming up from the class. This study offers nothing on this point.

APPENDIX

Form Letter Sent Out to 100 Producers and Distributors

Belmont, Mass.

November 12, 1938

Gentlemen:

I am interested in your complete listing of all 16 m m educational films, both silent and sound. Would you send whatever literature you may have that would furnish me with the following details:

a. Type of film (sound or silent)
b. Title of film
c. Length of film
d. Description of film
e. Price - rent or sale
f. Terms if film is rented
g. Terms if film is free
h. Producer of films
i. Nearest distributor to Boston

I trust that you will find it convenient to answer as soon as possible.

Very truly yours,

List of Producers and Distributors

Form Letters Were Sent To The Following:	Checks Designate That A Reply Was Received
Akin and Bagshaw, Inc. 1425 Williams St., Denver, Colorado	X
American Iron and Steel Institute 350 Fifth Avenue, New York City	
American Museum of Natural History 77th St., and Central Park West, New York City	X
Amkino Corporation 723 Seventh Ave., New York City	X
Ampro Corporation 2839 N. Western Ave., Chicago, Illinois	X
Bausch and Lomb Optical Company 635 St. Paul St., Rochester, New York	X
Bell and Howell Company 1801 Larchmont Ave., Chicago, Illinois	X
Bray Pictures Corporation 729 Seventh Ave., New York City	X
Browning, Irving Studios 110 W. 40th St., New York City	X
Castle Films R.C.A. building, Rockefeller Center, New York City	X
Chicago Film Laboratory, Inc. 18 W. Walton Place, Chicago, Illinois	X
Chicago, Rock Island and Pacific Railway Company Room 723 La Salle St., Station, Chicago, Illinois	
Frank R. Church Films 829 Harrison St., Oakland, California	X
Cine Classic Library 1041 Jefferson Ave., Brooklyn, New York	X

	Reply Received
Columbia Pictures Corporation 729 Seventh Ave., New York City	X
Commonwealth Pictures Corporation 729 Seventh Ave., New York City	X
H. O. Davis 522 Broadway, Oklahoma City, Oklahoma	X
William M. Dennis 2506½ W. 7th St., Los Angeles, California	X
Herman A. De Vry, Inc. 1111 Center St., Chicago, Illinois	X
M. E. Diemer Photographic Laboratory Madison, Wisconsin	
William H. Dudley Visual Education Service, Inc. 736 S. Wabash Ave., Chicago, Illinois	X
Eastin 16 m m Pictures 322 Ripley St., Davenport, Iowa	X
Eastman Kodak Company "Kodak Cinegraphs" Rochester, New York	X
Eastman Kodak Company. Teaching Films Division 343 State Street, Rochester, New York	X
Edited Pictures System, Inc. 330 W. 42nd St., New York City	X
Educational Film Service 77 Woolnough Ave., Battle Creek, Michigan	X
Educational Research Association 387 Plumosa Drive, Pasadena, California	
Educators Film Library 1600 Broadway, New York City	
Erpi Picture Consultants, Inc. 250 W. 57th St., New York City	X
Exhibitors Film Exchange 630 Ninth Ave., New York City	X
F. C. Pictures Corporation 505 Pearl St., Buffalo, New York	X

	Reply Received
Film Exchange Incorporated 125 W. 45th St., New York City	X
Films Incorporated 330 W. 42nd St., New York City	X
Films of Commerce Company, Incorporated 35 W. 45th St., New York City	X
Fitz Patrick Pictures, Inc. 729 Seventh Ave., New York City	
William J. Ganz 507 Fifth Ave., New York City	X
Garrison Film Distributors, Inc. 1600 Broadway, New York City	X
Gaumont British Picture Corporation of America 1600 Broadway, New York City	X
General Electric Company. Visual Instruction Section, Publicity Dept. 1 River Road, Schenectady, New York	
Gibson Studios Carselton, North Dakota	X
P. H. Glaffelter Company Spring Grove, Pennsylvania	
Walter O. Gutlohn, Inc. 35 W. 45th St., New York City	X
Harcol Motion Picture Industries 610 Baronne St., New Orleans, Louisiana	X
Harmon Foundation Inc. Division of Visual Aids 140 Nassau Street, New York City	X
Hartley-Leonard Productions 210 W. 78th St., New York City	
Harvard Film Service Biological Laboratories, Cambridge, Mass.	X
Hemenway Film Co. 37 Church Street, Boston, Mass.	X

	Reply Received
J. H. Hoffberg, Inc. 729 Seventh Ave., New York City	X
Hollywood Film Enterprises, Inc. 6060 Sunset Blvd., Hollywood, California	X
Ideal Motion Picture Service 6 St. Johns Ave., Yonkers, New York	X
Ideal Pictures Corporation 30 E. Eighth St., Chicago, Illinois	X
Ideal Pictures Corporation 729 Seventh Ave., New York City	X
Imperial Distributing Corporation 729 Seventh Ave., New York City	
Institutional Cinema Service, Inc. 130 W. 46th St., New York City	X
International Film Bureau 59 E. Van Buren St., Chicago, Illinois	
Kodascope Libraries, Inc. 33 W. 42nd St., New York City	
Lenauer International Films, Inc. 202 W. 58th St., New York City	
Lewis Film Service 224 N. Market St., Wichita, Kansas	X
Linde Air Products Company 30 E. 42nd St., New York City	X
Manse Library (Karl W. Schenfler) 2439 Auburn Ave., Cincinnati, Ohio	X
Massachusetts Institute of Technology-Visual Aids Dept. Cambridge, Mass.	X
Mc Larty Motion Picture Service 75 Enola Ave., Kenmore, New York	
Arthur Mayer and Joseph Burstyn 505 Paramount Bldg., New York City	

	Reply Received
Metropolitan Motion Picture Company 50 Branford Place, Newark, New Jersey	X
Michigan Department of Conservation, Educational Division Lansing, Michigan	
Michigan Film Library 18970 Grand River Ave., Detroit, Michigan	X
Modern Film Sales Corporation 729 Seventh Ave., New York City	
Mogull Brothers 1944 Boston Road, New York City	X
Motion Picture Service 1711 Ravenna Blvd., Seattle, Washington	X
National Cinema Service Hudson City, Box 1, Jersey City, New Jersey	X
National Motion Picture Company Mooresville, Indiana	X
National Motion Picture Service 723 Seventh Ave., New York City	X
Norris Brothers Productions 6406½ Sunset Blvd., Hollywood, California	
Northwestern Yeast Company 1750 N. Ashland Ave., Chicago, Illinois	
Nu-Art Film Co. 145 W. 45th St., New York City	X
Dr. Francis S. Onderdonk 1331 Geddes Avenue, Ann Arbor, Michigan	
Pan American Airways, Inc. District Traffic Manager 135 E. 42nd. St., New York City	
Pathescope Company of America, Inc. 33 W. 42nd. St., New York City	
Pictorial Film Library, Inc. 130 W. 46th St., New York City	

	Reply Received
Pinckney Film Service 1028 Forbes St., Pittsburgh, Pennsylvania	X
Providence School Department, Director of Visual Education Providence, Rhode Island	
Ray-Bell Films, Inc. 2269 Ford Road, St. Paul, Minnesota	X
Ernest M. Reynolds 165 E. 191st St., Cleveland, Ohio	X
Ro-lab Photo-Science Laboratories Sandy Hook, Connecticut	
Roosevelt House Library and Museum 28 E. 20th St., New York City	
Rutgers Films, New Jersey Hall, Rutgers University New Brunswick, New Jersey	
Scientific Film Company 20 Lanvale Ave., Daytona Beach, Florida	
Society for Visual Education, Inc. 327 S. LaSalle St., Chicago, Illinois	
Stark Films 219 W. Center St., Baltimore, Maryland	X
Text Film Corporation 6404 Sunset Blvd., Hollywood, California	
Howard E. Thompson 15 Newkirk Ave., Trenton, New Jersey	X
United Film Libraries 149 W. 48th St., New York City	X
United Projector and Film Corporation 228 Franklin St., Buffalo, New York	X
United States Dept. of Agriculture Division of Motion Pictures Washington, D. C.	X

	Reply Received
United States Dept. of the Interior Division of Motion Pictures Washington, D. C.	X
Victor Animatograph Corporation, Film Division 242 W. 55th St., New York City	X
Visual Education Service 470 Stuart St., Boston, Mass.	X
James Henry White Lake Ariel, Pennsylvania	
Wholesome Film Service 48 Melrose Street, Boston, Mass.	X
World Pictures, Inc. 729 Seventh Avenue, New York City	

16 m m Films Not Selected For The Reasons Cited

Title	Type	Reason For Not Selecting
1. Air Currents	Sound	Sound film.
2. American Red Cross to the Rescue	Silent	Material failed to meet objectives of unit.
3. Atmosphere	Silent	Not available for dates required.
4. Back of Weather Forecast	Silent	Withdrawn by producers.
5. Clouds	Silent	Material limited to but one phase of unit.
6. Dewfall-Nature's Jewels	Silent	Material limited to but one phase.
7. Fire Weather	Sound	Sound film.
8. Fury of Storm	Sound	Sound film.

16 m m Films Not Selected For The Reasons Cites (Contd.)

Title	Type	Reason For Not Selecting
9. Hell Below Zero	Sound	Sound film.
10. Ice in Nature's Workshop	Sound	Sound film.
11. Mad Ohio	Silent	Material limited to floods only.
12. Man Against River	Sound	Sound film.
13. Mysteries of Snow	Silent	Only 2/3 of a reel on snow--too limited.
14. Niagara's Winter Wizardy	Silent	Limited material on but one phase.
15. Plow That Broke The Plains	Sound	Sound film.
16. Rain For the Earth	Sound	Sound film.
17. Reconquering Antarctica	Silent	Withdrawn from circulation.
18. Snowdrops in All His Glory	Sound	Sound film.
19. Story of a Disturbance	Sound	Sound film.
20. Story of Water	Silent	For sale only.
21. The Forest and Waters	Silent	Did not meet with objectives.
22. Water in Air	Sound	Sound film.

Directing Questions Used At The Introduction Of The Film

" Atmospheric Pressure "

1. Which is heavier, dry air or air containing water vapor?
2. What effect does altitude have on air pressure?
3. Who made the first mercurial barometer?
4. How do the aneroid and mercury barometers differ?

Directing Questions (Contd.)

5. What is the pressure at sea level?

6. Is it the same in summer as in winter?

7. What is a barograph?

8. Why are inches used in measuring with the barometer?

9. The altimeter and barometer are very similar. How is the altimeter used?

10. Why is the barometer the best single instrument in weather forecasting?

"Water Cycle"

1. What are the main steps in the water cycle?

2. What causes vapor to condense?

3. Name the four principal types of clouds?

4. From which cloud do we get our rain?

5. What is the fair weather cloud called?

6. Why does dew form on the grass and buildings on a perfectly clear evening?

7. Is snow frozen rain?

8. What is the wet and dry bulb thermometer like?

9. Which column records the lower temperature on the wet and dry bulb thermometer?

10. What is sleet?

11. What do we find on a relative humidity chart?

12. How is one read?

"Climate"

1. What are the names of the zones of the earth?

2. Why is the equatorial belt so warm?

Directing Questions (Contd.)

3. Where do the trade winds originate?

4. Where are the horse latitudes?

5. Why are beach resorts cool in summer?

6. Where may we find the most abundant vegetation on the earth?

7. Where is the coldest region on the earth?

8. How can a record be kept of temperature throughout the day without employing the services of someone all day long?

9. How do latitude and longitude mark off the regions of the world?

10. What are the monsoon winds?

11. In which zone arethe occupations most varied?

12. Is the sun ever directly over our heads at noon?

"Weather Forecasting"

1. Are weather signs always dependable?

2. What is the U. S. Weather Bureau?

3. How many stations are there?

4. What is a weather map?

5. How may we interpret this map?

6. Are there certain rules to go by?

7. How would you describe a rain gauge?

8. Where do most of our storms come from?

9. Differentiate between cyclones and hurricanes.

10. How may we forecast the weather over long periods?

11. Can you anme and describe the principal weather instruments?

12. How is it possible to record all the observations on the daily weather map?

Directing Questions (Contd.)

13. How are reports gathered and sent in?

14. Why do thunder storms usually occur during warm weather?

General Plan of Subject Matter Taught In "Atmospheric Pressure" Unit

I. Content

A. Atmospheric pressure is one of the important factors interacting with others to produce our weather conditions.

1. Problem--What are the general characteristics of atmospheric pressure?

a. Approach

1. "Boiling" eggs on Pike's Peak.
2. How aviators and balloonists know their altitudes.
3. Climbing a mountain.

b. Subject matter and suggested activities

1. A study of air pressure

a. air exerts pressure in all directions
Demonstrations--electric fan, vacuum cleaner, key experiment from text.

b. air pressure varies with temperature
Demonstration--convection

2. c. air pressure varies with altitude
Show the varying temperatures of water boiling at different pressures.

d. air pressure varies with the humidity
Compare weights of water vapor and air per cubic foot. Explain why smoke falls to the ground on certain days.

e. the barometer and barograph are used to measure and record pressure and changes of pressure.
Demonstrate each.

c. Vocabulary

atmosphere humidity Torricelli Galileo
barometer aneroid barograph altitude

d. Evaluation

multiple choice test of 25 questions.

e. References

Text p. 548-554
Peiper & Beauchamp p. 113-119
Watkins & Bedell p. 19-21
Weed, Rexford, Carroll p. 628
Davis & Sharpe 109-111
Lake, Harley, Welton p. 137 ff

General Plan of Subject Matter Taught In "The Water Cycle" Unit

I. Content

A. The steps in the water cycle make possible life upon our earth.

1. Problem--A study of the water cycle.

a. Approach

1. Story of the rain drop.
2. Where does water go when it "dries up"?

b. Subject matter and suggested activities

1. Steps in water cycle

a. Evaporation

demonstrate damp cloth on meter balance

b. Condensation

demonstrate dew point with ice, water, salt and shiny cup. Make a cloud in a flask.

c. Precipitation

rain, snow, hail, all forms.

2. Ground water

show pictures of caves

3. Surface water
use opaque projector to show pictures of flood scenes.

c. Vocabulary

evaporation	fog	snow	cirrus	stratus
condensation	dew	rain	cumulus	stalactites
precipitation	mist	hail	nimbus	water table

d. Evaluation

multiple choice test of 25 questions.

e. References

Text p. 560-566
Lake, Harley, & Welton p. 126-137
Trafton & Smith p. 95-100
Pieper & Beauchamp p. 103-111
Watkins & Bedell p. 28-34
Weed, Rexford, Carroll p. 629-632
Davis & Sharpe p. 101-106

General Plan of Subject Matter Taught In "Climate" Unit

I. Content

A. Climate is the sum total of all weather factors for definite periods of time, which affects the plants, animals, people, occupations, industries, health, sports, and habitats of the peoples of the world.

1. Problem--To discover the effects of climate throughout the world and especially in our own land.

a. Approach

1. Why is there a "midnight" sun in certain regions.
2. Explain the slow deliberate movements, and the soft, low drawl of our southerners.

b. Subject matter and suggested activities

1. Zones of the earth

   a. locate and discuss their boundaries
   b. chart the relation of these to sun on the first day of each season
   c. show how world winds are formed

      1. Trades--anti-trades
      2. Doldrums--horse latitudes

   d. temperature variations

      1. angle of sun's rays
         demonstrate with flash bulb
      2. surface absorption
         demonstrate with dark and shiny cups
      3. topography
      4. influence of mountain ranges
      5. presence of bodies of water
      6. measurement
         Fahrenheit and Centigrade
         Maximum and minimum thermometers

2. Influence on Mankind

   a. Peoples and occupations
      Discussion

   b. Plants and animals
      Pictures showing wide variance

   c. Industry and education
      Discussion

   d. Health and Habits
      Discussion
      Pictures on opaque projector

   e. Shipping and aviation
      Slide and opaque projectors
      Discussion

3. Vocabulary

zones	doldrums	thermograph	temperate
tropics	latitude	fahrenheit	frigid
belts	longitude	centigrade	torrid

4. Evaluation

multiple choice test of 25 questions

5. References

Text p. 570-576
Pieper & Beauchamp 90-103
Davis & Sharpe 106-109
Weed, Rexford, Carroll 637-641
Watkins & Bedell 40-41
Trafton & Smith p. 85 & 91-93
Lake Harley & Welton p. 120-125
139-141

General Plan of Subject Matter Taught In "Weather Forecasting" Unit

I. Content

A. Life, property, and well being depend upon the ability of our weather bureau to accurately diagnose the many conditions that constitute our weather.

1. Problem--To discover the types of storms, their characteristics and the work of the weather bureau.

a. Approach

1. "The Boy With the U. S. Weather Man", a school library book.

2. The Boston Weather Bureau
3. A thunder shower in Belmont
4. Mark Twain's "Everybody talks about the weather and yet no one does anything about it."
5. Weather superstitions and signs.

b. Subject matter and suggested activities

1. The definition of weather

2. Storm paths in the U. S.

a. Cyclones and anti-cyclones
Discussion

b. Tornadoes or twisters

1. demonstrate anemometer
2. opaque projection of pictures

c. Local storms

1. thunder showers
   discussion of causes

3. The work of the U. S. Weather Bureau

a. Organization--over 200 weather stations

b. Work of the weather station

1. observations
2. weather maps

show sample to class
trace storm paths
trace cyclonic areas
trace anti-cyclone areas
learn the symbols

4. Other weather forecasters

a. Radio

listen to one o'clock broadcast

b. Newspapers

class project to keep reports for two weeks

c. Vocabulary

iso-bar	"Low"	anti-cyclone
iso-therm	anemometer	tornadoe
"high"	cyclone	rain gauge

d. Evaluation

multiple choice test of 25 questions

e. References

Text p. 568-570	Watkins & Bedell p. 37-40
Lake, Harley, Welton p. 141-153	Davis & Sharpe p. 110-115
Trafton & Smith p. 100-109	Pieper & Beauchamp p. 119-129

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